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THE RADIOCARBON METHOD OF AGE DETERMINATION*

W. S. Broecker and J. L. Kulp

FIVE YEARS after the first publication of age measurements by the radiocarbon method (Arnold and Libby 1951) the method has been established as a powerful technique in the study of archaeology. Lists of radiocarbon dates have been published by a number of laboratories (Libby 1951, 1952, 1954, 1955; Kulp 1951, 1952; Broecker and Kulp 1956; Suess 1954; Ruben and Suess 1955; Blau, Deevey, and Gross 1953; Preston, Person, and Deevey 1955; Ralph 1955; Anderson, Levi, and Tauber 1953). A few scientists feel that the radiocarbon dates contradict archaeological or geological theories which they regard as well-founded and have suggested that because of this the method is invalid. But the physical or chemical mechanics which they suggest to explain the alleged fallacy in the method are simply not plausible. If the method is not valid there is no physical or chemical explanation at the moment. Because of the great importance and widespread use of radiocarbon dating in archaeology, it is imperative that the historical scientists be aware of the basis as well as the limitations of the method. It is the purpose of this paper to describe the principles and to discuss the possible sources of error in radiocarbon determinations and the limitations they place upon the method.

Principles. In order to understand the limitations of the C^{14} isotopic clock it is first necessary to appreciate the physical principles on which the method is based. The element carbon has 3 naturally occurring isotopes known as C^{12}, C^{13}, and C^{14}.

The isotopes of any given element have the same number of protons in their nuclei but differ in neutron number. The 3 carbon isotopes have 6 protons each and 6, 7, and 8 neutrons, respectively. The summation of the neutron and proton number is used to identify a given isotope, hence, C^{12}, C^{13}, and C^{14}.

C^{14} differs from the other 2 isotopes of carbon in that it is unstable. That is, 8 neutrons cannot live happily with 6 protons and there is a tendency to change this configuration. This alteration is accomplished by the ejection of a so-called beta particle or electron from the C^{14} nucleus which results in the conversion of one of the excess neutrons into a proton giving the atom 7 neutrons and 7 protons which makes it a nitrogen atom (Fig. 1).

The average C^{14} atom lives about 8000 years before this disintegration occurs. Another way to express the stability of a radioactive isotope is to consider the time required for half of a given number of atoms of a given isotope to decay, that is, the "half life." Thus, in the case of C^{14} which has a half life of about 5570 years, only half of a known number of C^{14} atoms today would remain after 5570 years, the other half having converted themselves into nitrogen atoms. At the end of 11,140 years only one quarter of the original atoms would remain. Each succeeding 5570 years the number of C^{14} atoms would decrease by another factor of two. This property of C^{14} which causes its population to decrease by this particular pattern is shared by all radioactive isotopes and is one that cannot be altered by any physical conditions met with on the earth. Thus, the inherent mechanism of this and all other isotopic clocks is not subject to variation. The rate of decay is proportional to the number of atoms of a particular isotope that are present, and nothing else. The time interval involved differs for each individual isotope varying from fractions of a second to millions of years. There are other factors such as laboratory error or contamination that may make the C^{14} clock give erroneous readings but the basic mechanism, that is, the rate of radioactive decay, is always constant.

* Lamont Geological Observatory Contribution No. 192. The work described in this report was supported under National Science Foundation Grant 1334. In preliminary form this paper was read at The Great Basin Archaeological Conference, Los Angeles, in August, 1955.

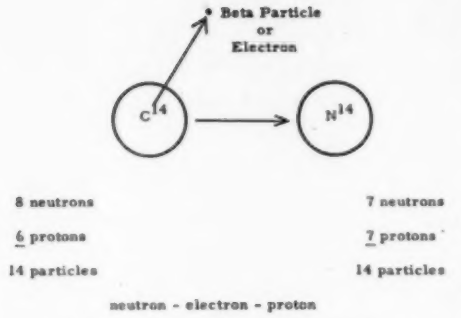

FIG. 1. Nuclear Reaction Producing C^{14}.

Various types of physical measurements make it possible to predict accurately these half-life time intervals. This has been done for C^{14} independently by several investigators (Jones 1949; Libby 1949; Miller 1950) with good agreement, the best average being 5568 years with a probable error of 40 years either side of this mean.

Since the earth is on the order of 5 billion years old, any C^{14} produced during the creation of the elements would have long since disappeared. However, C^{14} is observed on the surface of the earth. Primary cosmic ray particles produce neutrons upon entering our atmosphere which react with the abundant N^{14} atoms. This reaction involves a neutron entering the nucleus of a N^{14} atom knocking out a proton converting the N^{14} atom to a C^{14} atom (Fig. 2). If this production has proceeded at a constant rate for many thousands of years then the amount of C^{14} present on the surface of the earth would have reached a constant value. This can be most easily understood by considering the flow of water through a funnel. If water is poured into a funnel at a uniform rate the water will rise to some constant height in the funnel as long as the rate of addition is not altered. Even though water is continually entering and leaving the funnel, the amount inside remains constant. Likewise, since the rate of decay of C^{14} atoms is a function only of the number of atoms present, the total number of C^{14} atoms in the reservoir (atmosphere, biosphere, and hydrosphere of the earth) must be constant if the rate of production has been maintained constant.

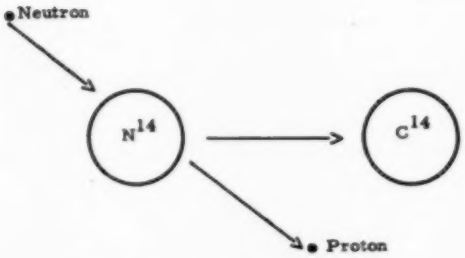

FIG. 2. Radioactive Decay of a C^{14} Atom.

The C^{14} produced in the atmosphere gradually mixes with all the other carbon in the CO_2 cycle and if this mixing is rapid with respect to the half life, the percentage of C^{14} in the carbon in the earth's atmosphere, waters, living plants, and living animals should be essentially a constant. When removed from the CO_2 cycle the C^{14} content of the carbon would begin to decrease at the rate of one half every 5570 years. Hence, if the C^{14} concentration in the carbon from a plant of unknown age were measured and found to be one half that in a living plant, the age of the plant would be estimated as 5570 years.

The relative abundances of the 3 carbon isotopes in living wood and fossil coal are shown in Table 1. The C^{12} and C^{13} percentages are the same in each case since these isotopes are not radioactive and hence do not change with time. C^{14} is not detectable in coal because of its great age. The amount in living wood is so small that but for the electron it emits when it

TABLE 1. ISOTOPIC COMPOSITION OF CARBON.

Living Wood		
C^{12}	= 98.85	%
C^{13}	= 1.15	%
C^{14}	= .000,000,000,107	%
Coal		
C^{12}	= 98.85	%
C^{13}	= 1.15	%
C^{14}	= .000,000,000,000	%

changes to nitrogen its presence would go undetected. These radioactive emissions can be detected, however, with a Geiger counter. Even this measurement is very difficult because of the small number of these electrons and their lack of penetrating power. Special techniques were developed to eliminate as much extraneous radiation as possible from the Geiger counter.

The background radiations due to cosmic rays and to the small amounts of uranium which are found in all rocks and minerals tend to obscure the few radiations from C^{14}. This problem is overcome by placing the Geiger counter in an iron tomb with 8-inch thick walls which absorb the electromagnetic radiations from uranium and by surrounding the counter with a ring of permanent Geiger counters which measure the number of cosmic rays which pass through the iron. If the electronic system is arranged so that coincident pulses from the ring and the sample counter are canceled, the cosmic ray background is removed.

Libby's original method of measurement (Libby 1955) involved converting the carbon in the unknown sample to pure carbon black and coating it on the inside of a steel cylindrical shell which was then placed in the Geiger counter. Recently more sensitive methods have been developed which involve the conversion of the carbon in the unknown sample to some carbon bearing gas such as carbon dioxide, methane, or acetylene which is placed within the counter in the gas phase. The radiations given off are averaged over a period of 24 hours or longer depending on the precision required.

Sources of Error. Consideration of the theory and measurement technique required for the radiocarbon age method brings out several possible sources of error. These can be divided into 2 groups: errors in the assumptions and measurement errors. Measurement errors are similar to those encountered in any physical determination with the added difficulty that the radiations occur randomly. The estimate of the average rate of radioactive decay increases in accuracy as the number of particles counted increases, just as the actual ratio of heads to tails in flipping a coin approaches one with an increasing number of trials. In 10 flips 5 heads and 5 tails would not always be obtained even though the probability of obtaining heads is 50%. One could conceivably get 8 heads and 2 tails, whereas in 10,000 flips the number of heads would lie within a very few percent of 5000.

Three main assumptions are made: (1) the radioactivity measured in the sample is due completely to C^{14}, (2) the original C^{14} content of a sample can be estimated accurately, (3) no C^{14} is added or subtracted from the sample between the time of removal from the CO_2 cycle and measurement in the laboratory except that lost due to radioactive transformation.

The effect of these errors can be estimated in 2 different ways. One is to compare radiocarbon ages with those determined by other

TABLE 2. COMPARISON OF TREERING AND RADIOCARBON AGES.

Sample	Expected Age	C^{14} Age
L Sequoia	880±15	930±100
C Douglas Fir	1372±50	1100±150
L Sequoia	1377±4	1430±150
C Redwood	2928±52	3005±165

L - Lamont (Kulp et al. 1951)

C - Chicago (Arnold et al. 1949)

TABLE 3. COMPARISON OF HISTORIC AND RADIOCARBON AGES.

	Sample	Expected Age	C^{14} Age
L	Inca Temple	444± 25	450±150
B	Roman Ship	1990±3	2030±200
C	Ptolemy	2149±150	2300±450
B	Etruscan Tomb	2600±100	2730±240
C	Tayinot	2624±50	2600±150
C	Sesostris	3700±400	3792±50
C	Nippur	4125±200	3840±210
C	Sneferu	4575±75	4802±210
C	Zoser	4650±75	4979±350
C	Hemaka	4900±200	4883±200

L - Lamont (Kulp et al. 1951, 1952)

C - Chicago (Arnold et al. 1949)

B - Rome (Ballaria 1955)

TABLE 4. RADIOCARBON DATES ON MATERIALS OF SAME AGE.

Two Creeks Forest Bed (Chicago)	
Spruce Wood	10, 880±740
Tree Root	11, 437±770
Peat (around root)	11, 097±600
Spruce Wood	12, 168±1500
Peat	11, 442±640
Swiss Neolithic Lake Dwelling (Copenhagen)	
Spruce	4, 500±150
Ash	5, 080±280
Bark	4, 780±140
Charcoal	4, 720±130
Allerød (Boundary between Zones II and III) (Copenhagen)	
Lake Marl	10, 930±300
Wood	10, 890±240
Non-calcareous lake mud	10, 770±300

methods and with themselves which gives an estimate of the integrated error; the other is to examine the individual sources of error and predict what their combined effect would be.

Ultimate Calibration. Measurements made comparing radiocarbon ages with those obtained by other absolute methods have for the most part been in good agreement. Table 2 lists C^{14} ages made on samples of known treering ages and Table 3 of known historic ages. These indicate that ages within a few percent in accuracy can be obtained on samples in the 1000 to 5000 year age range. The samples, however, were preserved under ideal conditions and hence cannot be used as proof that alteration effects after removal of the sample from the CO_2 cycle are negligible. This can best be done by comparing radiocarbon measurements on samples of the same age but of different material type, preserved under nonideal conditions. Several cases are listed in Table 4. Perhaps the most convincing is the set measured in the Copenhagen Laboratory consisting of lake mud, wood, and marl. The carbon in the marl was in the form of $CaCO_3$ while in the other two it was in organic compounds. Any alteration would be expected to have quite different effects on the 2 types and the fact that agreement is obtained indicates that alteration effects are probably negligible. The only available approach to check the absolute validity of the radiocarbon dates on samples greater than 5000 years in age is a comparison with ages determined by the ionium method. This method is based on the decay of another radioisotope (Th^{230}) and is restricted to selected ocean sediments. Despite the large errors in the measurement the comparison shown in Table 5 indicates that the methods agree to within 15%. This is further proof of the validity of both methods. Relative radiocarbon dates of all ages are more easily checked by comparing ages on samples of known sequence. A few such sets are listed in Table 6.

The above comparison data indicate that none of the possible sources of error in C^{14} measurements has marked effect on the majority of C^{14} samples. However, in order to determine the cause of the smaller differences which appear in the comparisons, the individual sources of error must be surveyed. They are summarized in Table 7 as a function of the sample material used.

The laboratory error is independent of the sample type provided enough material is available. The sample sizes required for various material types are listed in Table 8. Listed in the first column are minimum amounts of material for a highly precise measurement. For cases

TABLE 5. COMPARISON OF IONIUM AND C^{14} AGES ON SELECTED OCEAN CORE SAMPLES. (KULP AND VOLCHOK 1953)

Core No.	Ionium Age	C^{14} Age
P - 130-28	1100±400	1500±500
P - 130-118	7000±1000	8200±800
P - 130-185	15, 000±1000	14, 000±2100
P - 126-24	16, 000±1000	17, 500±2000

where the amount of material available is extremely limited, special techniques have been developed to make measurements on very small samples with somewhat less precision. Column two indicates the approximate minimum amounts of various material types which are acceptable for radiocarbon measurement.

The Statistical Error Due to the Radioactive Process. The error most often quoted on radiocarbon ages is the so-called statistical error. This is done because the statistical error is often the major source of uncertainty and also because it readily lends itself to mathematical expression, whereas most other types of error do not. As stated above, this error decreases in magnitude as the length of the measurement time increases. To decrease the error by a factor of 2, however, the measurement period must be increased by a factor of 4, hence it becomes impractical to reduce this error beyond a certain point. Figure 3 shows a plot of age error against age for both the average black carbon measurement and the refined gas counting technique. The plus error is plotted above the zero line and the minus error below. For moderate age samples the plus and minus error are nearly equal and hence most C^{14} ages are quoted in the form 4200 ± 200. For samples of extreme age the plus error becomes much greater than the minus error. For each method 2 lines appear, one marked 95% and the other 68%. The reason for this is demonstrated in the following example. If a large piece of wood of known age of 20,000 years were cut up into 1000 sections and each section were separately analyzed by the C^{14} method, it would be found that due to the randomness of the emission of the radiations, approximately 680 would give ages lying between 19,600 and 20,400. The remaining 320 would give ages either less than 19,600 or greater than 20,400 years. Of these 320 only about 40, however, would give ages less than 19,200 or greater than 20,800 years. Hence, the probability that the true age of a sample lies within the error quoted is 68%, and that it lies within twice the error is 96%. Were statistical error the only error involved, then virtually all C^{14} measurements made should be within 3 times the error quoted.

As indicated by the graph, in the region of 28,000 years the plus error on the average black carbon measurement becomes so large that the sample can no longer be distinguished from one with no C^{14} activity. Hence, all that can be said is that it has an age greater than a certain value. The development of the new gas counting techniques makes possible a fourfold reduction in error and the extension of the method's applicability back into the 40,000 year range. It should be emphasized that the errors shown on the graph are only averages and for any particular sample may be greater or smaller depending on the particular size of the sample and length and number of times it was measured.

TABLE 6. SAMPLES FROM KNOWN AGE SEQUENCE.

Hotu Cave Iran	**(Pennsylvania)**
Trench No. 1	
Subsurface	1220±230
190 - 200 cm.	2200±280
310 - 320 cm.	2685±210
400 - 415 cm.	2775±315
500 - 520 cm.	2860±380
590 - 660 cm.	4730±320
Trench No. 2	
580 cm	6385±425
765 cm.	8070±500
950 cm.	9190±590
1015 cm.	9220±570
Searles Lake	**(Chicago)**
73.7 feet	10,494±560
76.7 feet	15,089±1000
80.2 feet	18,000±730
83.3 feet	23,923±1800
Equatorial Atlantic Ocean Sediment Core (Lamont)	
0 - 5 cm	3630±170
18 - 21 cm.	11,260±460
38 - 41 cm.	13,430±570
57 - 64 cm.	18,910±680
77 - 83 cm.	23,000±1100
97 -103 cm.	26,700±1800
114 -125 cm.	32,300±3300
135 - 146 cm.	38,800±5600

TABLE 7. SOURCES OF ERROR AS A FUNCTION OF SAMPLE MATERIAL.

Material	Laboratory Error	Depositional or Growth Effects	Exchange	Intrusion
Fresh Wood	Same for all material types for optimum sample size ~±100 years at 5,000 years ~±300 years at 15,000 years ~±1000 years at 25,000 years sensitivity limit 40,000 years	±100 years C^{12}/C^{13} measurements might reduce slightly	usually negligible check by C^{12}/C^{13} measurements	easily detected
Decomposed Wood		"	"	error usually small but could be high in some cases
Charcoal		"	"	easily detected
Peat		"	"	error usually small but could be important in some cases
Uncharred Bone (inorganic)		±200 years	could cause large error	could cause large error
Uncharred Bone (organic)		±200 years	undefined	could cause large error
Shell marine		±160	negligible for uncrystallized shell	easily detectable
Shell lacustrine		variable with local conditions. Could be up to +1800 years too old for hard water lakes	"	"
Carbonate recrystallized		variable with local conditions	highly suspect	could cause large error
Carbonate unrecrystallized		"	probably quite small	usually small but could cause large error

The possibility of other types of laboratory error is ever present and is one of the reasons for the high cost of measurements. Extreme care and frequent checks of the equipment are necessary to insure the absence of errors. Adequate controls are provided so that if such errors are made they are almost invariably caught and hence influence only a very small percent of the published results.

TABLE 8. SAMPLE SIZE NECESSARY FOR C^{14} MEASUREMENT

Sample Type	*Optimum Amount*	*Minimum Amount*
$CaCO_3$	120 gm. or ¼ lb.	5 gm.
C	10 gm.	.4 gm.
Wood	50 gm.	1 gm.
Charcoal	40 gm.	1 gm.
Peat	100 gm.	2 gm.
Shell	180 gm.	8 gm.
Bone (Charred)	100 gm.	2 gm.
Bone (Uncharred)	1200 gm. or 2.5 lb.	50 gm.

Errors due to the assumptions made in the method do not lend themselves to mathematical expression and therefore are normally assumed to be negligible. This is justified in the majority of cases but in isolated samples and samples where high precision results are required these assumptions can be important sources of error.

Radioactive Contamination. The first of the 3 assumptions listed above is that the radioactivity of a sample is entirely due to C^{14}. One of the chief reasons for a switch by most laboratories from black carbon counting to gas counting was that it was difficult to be sure that this assumption was not violated. Atomic bomb tests have added sufficient radioactivity to the atmosphere at various times to make it extremely difficult to avoid having radioactive dust particles absorbed on the dry black carbon during preparation. Any radioactivity absorbed in this manner could not be distinguished during measurement and hence would raise the

TABLE 9. VARIATIONS IN THE C^{14} CONTENT OF CONTEMPORARY SAMPLES.

Material	Percent Difference of Average from Modern Wood	Range	Age Uncertainty of average is used
plants (normal)	0%	-1 to + 1%	± 80 yrs.
plants (highly calcareous soils)	-	-20 to + 1%	to - 1800
shell (normal)	+2%	- 0 to + 4%	± 160
shell (hard water lakes)	-	-20 to + 4%	to - 1800
bone (inorganic)	+2%	0 to + 4%	± 160
bone (organic)	+1%	1 to + 3%	± 160

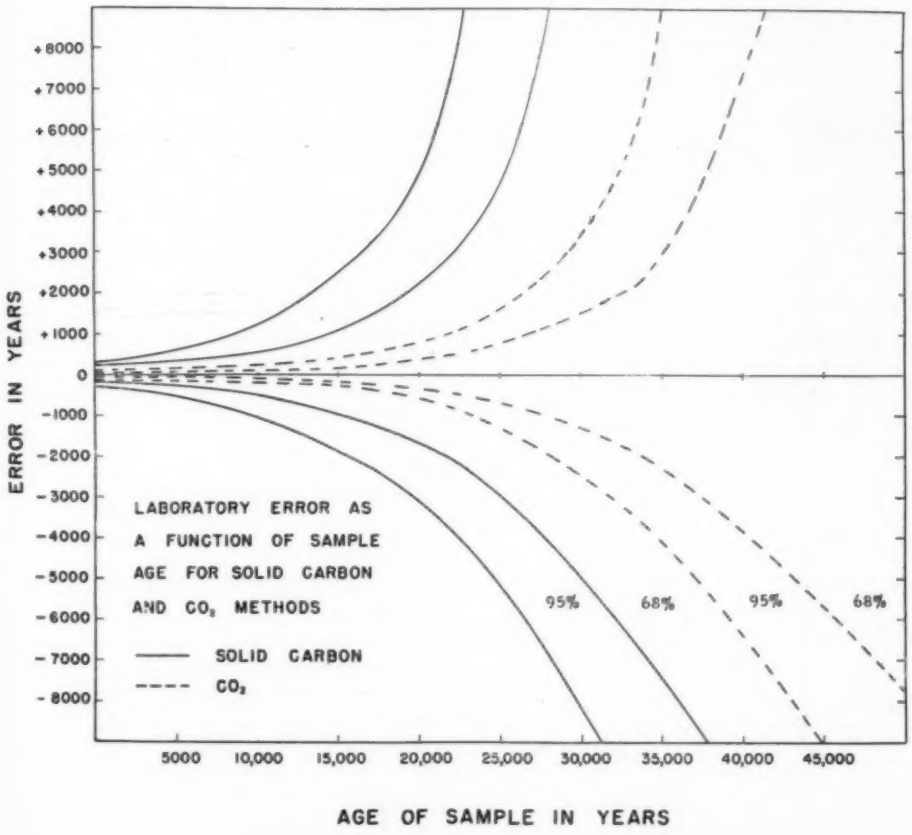

FIG. 3.

apparent sample activity, giving an anomalously low age. Most radiocarbon laboratories were aware of this problem and took steps to eliminate it, or at least to define when it was present. Despite the controls and care taken there are probably a few published ages which are too young for this reason. It should be emphasized that this problem had its effect mainly after large series of atomic tests, and that the large majority of dates published were made during periods when these effects were negligible. Also, the new gas counting techniques are entirely unaffected by this problem.

Aside from the atmospheric radioactive dust this assumption has been shown to be quite valid. Other types of radioactive substances in the sample have been shown to be entirely separated during chemical preparation. The only one which has a possibility of surviving is radon gas. Its presence, however, is easily detectable due to its 4-day half life and the high energy of its radiation. Hence with gas counting the first assumption is entirely justified.

Definition of Original C^{14} Concentration in Various Materials. The second assumption is that the original C^{14} content of materials of unknown age can be estimated accurately. This involves 2 separate problems: one to determine what variations occur in the C^{14} concentration in materials on the earth today, and the other

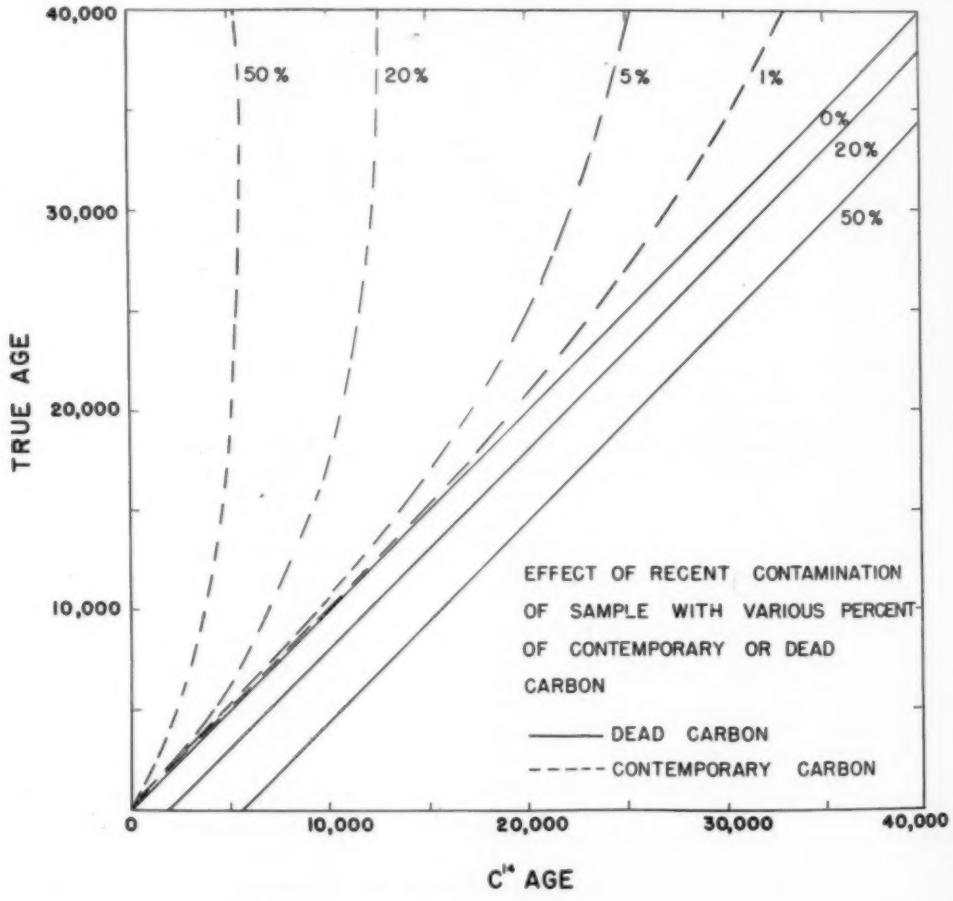

Fig. 4.

to determine whether the concentrations now found were the same throughout the past 40,000 years. In general it has been found that the C^{14} concentration in the carbon of all plants, animals, shells, air, and surface ocean water measured to date is the same to within $\pm 3\%$. Table 9 lists the concentration in various datable materials as compared to the mean for wood. The plus and minus give an estimate of the range. Two definite anomalies are found: (1) The first is for shells which grow in hard water lakes. Measurements indicate that C^{14} deficiencies up to 20% exist. If a sample which grew under these extreme conditions were assumed to have had the average C^{14} concentration of the carbonate in normal shells, a constant error of 1800 years would be introduced. Thus, a sample with a true age of 500 years would give a C^{14} age of 2300 years, and one with a true age of 22,000 years would give an age of 23,800 years. Hence, the effect is marked for recent samples but not very significant for those of great age. (2) The other anomaly recognized to date is that in low growing plants in caliche type or other extremely high carbonate soils. Again the effect could be as high as 20% introducing the same type of error as for the hard water shells.

These 2 anomalies are quite restricted and do not create any great problem in dating. Excluding these 2 anomalies, Table 9 gives the age uncertainty or error introduced by assuming an average value for each material type. For organic materials the variation is quite small and the extreme error introduced is probably less than 200 years. The variation in oceanic shells is slightly larger and the extreme error could be as high as 300 years.

To prove that these values have remained the same over the past 40,000 years is more difficult. There is no reason to believe that the relationship between the various material types would be much different than it is today, but it is possible that the absolute mean has changed with time. The primary cause of such a change would be a change in the intensity of cosmic ray flux entering our atmosphere. Comparisons of radiocarbon ages with samples of known age indicate that the change has been small during the past 5000 years, and comparisons with ionium ages indicate the change has not been drastic during the past 25,000 years. Table 10 shows the effect on radiocarbon ages if the cosmic ray flux doubled at the close of the Wisconsin 10,000 years ago. Even this drastic change does not have too great an effect on radiocarbon ages. There is no theoretical reason to expect changes anywhere near as large as this. It should be emphasized that any such changes would have no effect on relative C^{14} ages, only on their absolute value.

Alteration of C^{14} Concentration After Removal From CO_2 Cycle. The third assumption is that the C^{14} concentration in the carbon of the sample is not altered in any manner, from the time of removal of the sample from the CO_2 cycle until it is measured in the laboratory, except by radioactive decay. This could happen in 3 ways: by fractionation, exchange, or intrusion.

The process of fractionation involves the selective removal of one carbon isotope relative to another. This might happen during the process of bacterial decay of organic materials if the organisms were to eat more C^{14} atoms than C^{12} atoms, or vice versa. Fortunately such an effect would also cause a change in the ratio of C^{13} to C^{12} of close to one half the change produced in the C^{14} to C^{12} ratio. Measurements of C^{13} to C^{12} ratios in decayed wood show no difference from those in well-preserved wood, indicating that this effect is negligible.

The second type of alteration which might affect the C^{14} concentration is exchange of original carbon atoms in the sample structure with carbon atoms carried in solutions passing over the sample. Since the carbon carried in aqueous solutions found in nature is predominantly in the form of carbonate, and since the chance of the transfer of carbon atoms between an organic compound and a carbonate ion is remote, this effect is probably very small in the case of organic materials. Shells, however, are known to exchange their carbon primarily during recrystallization. For coarse grained shell which is unrecrystallized the amount of replacement is negligible. Slight differences in oxygen

TABLE 10. EFFECT ON C^{14} AGES IF COSMIC RAY FLUX DOUBLED 10,000 YEARS AGO

True Age	C^{14} *Age*
40,000 years	35,000 years
30,000 years	25,000 years
20,000 years	15,000 years
15,000 years	10,000 years
10,000 years	8,000 years
5,000 years	4,200 years

isotope ratios are known to have been preserved in shells for periods well over 1 million years, indicating exchange is negligible in the radiocarbon age range. For fine grained carbonates where it is difficult to determine whether recrystallization has occurred, this assumption may not be valid. The resulting error might make the age appear either too young or too old depending on the source of the exchanging carbonate. Ground water flowing through old limestone would presumably be deficient in C^{14} in the carbonate ion, whereas river water might have essentially the C^{14} concentration of carbonate in equilibrium with the atmosphere.

There is a distinct possibility in many cases of intrusion of a sample with carbon of another age. For instance, the intrusion of an old sample with rootlets of recent vegetation, or deposition of old carbonate in the porous structure of a bone is known to occur and must be carefully guarded against in choosing samples for measurement. Figure 4 indicates the magnitude of the error introduced by adding various percents of contemporary or very old carbon to samples of various ages. The addition of small amounts of dead carbon does not have too marked an effect except on very recent samples. Even 20% addition to a sample 20,000 years old would only change its C^{14} age to 21,800. On a sample 1000 years old, however, 20% addition would cause an apparent age of 2800 to be obtained. The addition of modern carbon has a very marked effect on samples of great age. The addition of 5% to a sample 30,000 years old would give it an apparent C^{14} age of only 22,000 years. In certain material types contamination is more easily recognized than in others. Fresh wood, pure charcoal, and coarse grained shell are probably most reliable from this standpoint. It is less easily recognized in peat and decomposed wood and very difficult to recognize in partially charred or uncharred bone because of its extremely porous structure and low carbon content.

Evaluation. From the standpoint of reliability in the light of the assumptions made in the C^{14} method charcoal (including thoroughly charred bone), fresh wood, and coarse marine shells are the most useful samples. Peat and decomposed wood are usually reliable, but care must be taken to eliminate any rootlets or other organic intrusives. Carbonates are routinely removed in the laboratory and hence need be of no concern when considering organic materials. Fine grained carbonate, partially charred and uncharred bone should be used only with the greatest caution.

When very high precision is required, especially on recent samples, the precision of the estimate of the original C^{14} content must be taken into account. Also it must be remembered that the probability that a radiocarbon age lies somewhat outside the limits of the probable error is about 30%.

Another problem is that a C^{14} determination gives an estimate of the time at which the carbon in a particular sample was removed from the CO_2 cycle. Whether this date represents the time of an event in which the archaeologist is interested must be determined carefully in the field. Taking this possibility of error into account and combining it with those listed above, it becomes clear why a small percentage of individual dates which have been published have appeared anomalous. Where multiple consistent dates have been made on a single site and where individual C^{14} dates agree with other evidence, the archaeologist has every reason to be confident in radiocarbon ages. Since hundreds of radiocarbon dates have now been made which are self-consistent and which are confirmed by other types of evidence, the likelihood of systematic error invalidating the results appears most remote. Individual samples may appear anomalous. In such cases further field and laboratory work must be done to resolve the problem. In each case where this has been done the anomaly has been resolved.

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THE SECOND MAMMOTH AND ASSOCIATED ARTIFACTS AT SANTA ISABEL IZTAPAN, MEXICO*

LUIS AVELEYRA A. DE ANDA

AMONG THE numerous problems still to be resolved in the archaeology of Mexico, one could not find a more captivating, more fundamental, and at the same time, less known one, than the early genesis of the native civilizations of Mesoamerica. Lack of knowledge of preceramic developments, which are the truly *formative* ones of the high prehispanic cultures, leaves the whole complicated sequence of better-studied civilizations without a real foundation. The investigation of this field requires collaborative research in the geological and paleontological sciences.

Curiously enough, these initial phases of prehistory in Mexico, in which a great scarcity of data is to be expected, already reveal a cultural picture of a definite form. The existence of a level of nomadic hunters of paleolithic type, at the end of the Pleistocene and within a natural environment different from the present in landscape, flora, and fauna, has been established definitely in the Valley of Mexico, and furnishes a point of departure for the study of human activity in the center of the country.

The present work reports a new discovery related to this phase of prehistory in the Valley of Mexico. The results obtained are not new, but rather, complimentary to previous investigations. The coexistence of man and fauna now extinct in this region was already indicated in the recent work of Mexican and foreign geologists (Arellano 1946a; Bryan 1946, 1948; de Terra 1946, 1949), and confirmed later by investigations and findings of the Dirección de Prehistoria of the Instituto Nacional de Antropología e Historia (Maldonado-Koerdell and Aveleyra 1949; Aveleyra and Maldonado-Koerdell 1952, 1953; Martínez del Río 1952).

Antecedents. The extraordinary prehistoric riches in the vicinity of Tepexpan in the northeast part of the Valley of Mexico, and the associations obtained there of man and fauna in the Pleistocene, render this zone one of the most important on the continent for the study of "paleo-Indian" cultures. Since more than a century and a half ago discoveries of fossil skeletal remains exposed in the plain of Tepexpan and adjacent sites have been made, but have been reported mainly in popular style in newspapers and magazines. Scientific information is, unfortunately, very scarce (Reyes 1923, 1927; Díaz Lozano 1927; Arellano 1946b). The findings of Reyes and Díaz Lozano are not very illustrative of human prehistory in the region, due perhaps to the exploratory techniques directed, from the paleontological point of view, at recovering fossils purely for their taxonomic and museum value. In the case of the mammoth skeleton excavated by Arellano (1946b) a possible association with an obsidian flake is mentioned.

In 1947 the discovery of Tepexpan Man, the first fossil human remains found in Mexico and one of the most remarkable discoveries in America, crowned the patient labor of Arellano and Bryan in the sediments of the Valley, and the integration of these problems achieved by Helmut de Terra.

The finding of Tepexpan Man aroused doubts about its authenticity in certain foreign circles, based principally on faults of observation on the part of the discoverers, and on some methodological dogmas in details of the exploration. This rigorous criticism, it must be warned, although well justified, was the product of a "tele-appreciation" of the facts, and without the appropriate knowledge of the series of previous investigations done by de Terra which were forming a perfectly clear picture of the geological, glacial, and lacustrine landscape of the region. Discoveries achieved a few years later bore out de Terra's belief in the existence of man as the hunter of mammoths in the Valley of Mexico at the end of the Pleistocene.

In 1952, only a few days after the Dirección de Prehistoria initiated its first field work, it was rewarded with the lucky finding of the first fossil mammoth at Santa Isabel Iztapan, scarcely 2 km. from the site of Tepexpan Man (Aveleyra and Maldonado-Koerdell 1952, 1953) and about 20 km. northeast of Mexico City. In

* Based upon Aveleyra's *El Segundo Mamut Fósil de Santa Isabel Iztapan, México, y Artefactos Asociados* (Publicaciones de la Dirección de Prehistoria, No. 1, Instituto Nacional de Antropología e Historia, Mexico, 1955). Translated and abridged by Alex D. Krieger. For more extended explanations, and especially for numerous fine photographs of the different stages of excavation, see the original.

direct association were 6 implements of stone, adding in a remarkable way to the picture of prehistoric man as a hunter of mammoths in this vicinity. The presence, in the plain of Tepexpan and nearby sites, of not less than a dozen skeletal remains of mammoth (including the findings of Reyes, Díaz Lozano, Arellano, and others), together with the new discoveries of Tepexpan Man and the first mammoth at Iztapan, all of them in a limited area, was a sure indication that toward the end of the Pleistocene, the zone of Tepexpan-Iztapan must have been the scene of systematic mammoth hunting on the edge of ancient Lake Texcoco.

The discovery of the second mammoth at Santa Isabel Iztapan also resulted from the plans for exploration of the Dirección de Prehistoria in this region. At the beginning of excavation of the first mammoth in March, 1952, a special effort was made to encourage local people and authorities to inform the Dirección about all "giant bones" they would find when excavating ditches and wells. At the end of May, 1954, notice was received of large bones found in digging an irrigation ditch in the village of Santa Isabel Iztapan. On inspecting the place it was proved that the bones in view were in situ and consisted of a portion of the base of the cranium and the proximal sectors of both tusks of a mammoth. Fortunately in this case, unlike the case of the first mammoth in which the cranium was destroyed by the local people when trying to extract it, the parts originally discovered were left in place and protected until the arrival of the Dirección de Prehistoria. The only pieces removed from

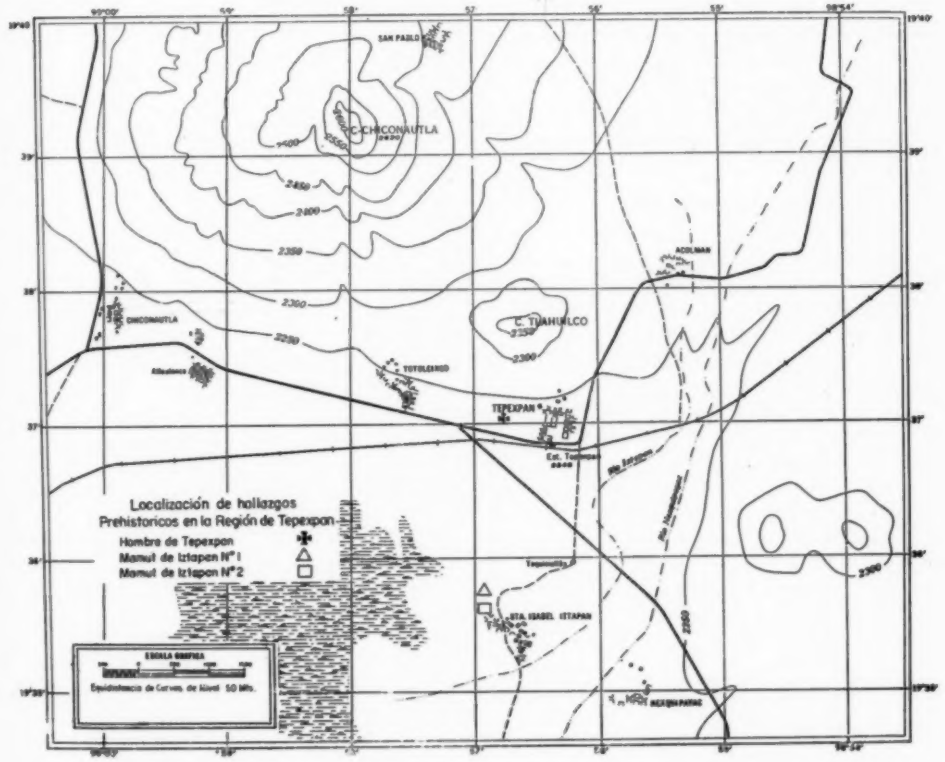


FIG. 1. Map of Tepexpan area in northwestern portion of Valley of Mexico. The Pan-American Highway runs north from the village of Chiconautla (at the left); the road to San Juan Teotihuacán runs eastward through Tepexpan and Acolman, then north to the pyramids of Teotihuacán (off map to upper right). The marginal marshes of present Lake Texcoco appear at the lower left. Mexico City lies about 20 miles southwest of Tepexpan.

their original place were both upper molars (the first part of the skeleton which the picks encountered on deepening the ditch) which were kept in a safe place and later given to the author.

The exploration began on June 1, 1954, and ended on the 12th. It was in charge of the author and Arturo Romano Pacheco, physical anthropologist of the Dirección, to whom should be credited the unsurpassed excavation technique employed. Manuel Maldonado-Koerdell was in charge of the geological study (see Appendix) and collaborated actively in the excavation, as did a student of the Escuela Nacional de Antropología e Historia, Francisco Gonzáles Rul. In some phases of the exploration we also had the help of Pablo Martínez del Río, Joaquín Cortina Goríbar, and the students Lilia Trejo de la Rosa, Mónica Bopp, and Carmen Block.

We must acknowledge the invaluable financial help received from several persons: the important annual subsidy received from Petróleos Mexicanos through its director Antonio J. Bermúdez, has been indispensable to almost all the investigations achieved by the Dirección since the date of its foundation; the sum annually donated by Bruno Pagliai beginning in 1955 will permit the Dirección to devote full time to the works related to the prehistory of Mexico; and to Gilberto Loyo, Secretario de Economía Nacional, are due the legal procedures which culminated in the acquisition of additional mobile equipment. José Kimball took the photographs of the artifacts. Most of the other photographs were taken by the anthropologist Arturo Romano. Miguel Ricardez, cartographer of the Secretaría de la Defensa Nacional, kindly prepared the map of the region which is included here (Fig. 1). Finally, it is necessary to mention the decisive collaboration of the local authorities of Santa Isabel Iztapan, especially the enthusiastic help of the brothers José and Rosendo Cortés, who originally reported the finding and made possible the exploration on their property.

Location of the Discovery and Local Topography. The second mammoth at Iztapan was found approximately 350 m. south of the first one (Aveleyra and Maldonado-Koerdell 1952), and some 2600 m. south (and slightly west) of the site of Tepexpan Man (Fig. 1). The locality, together with the plain of Tepexpan toward the north and the surrounding terrain, forms part of the great sloping plain resulting from the retreat of the waters of the present Lake Texcoco in its northeast portion. The plain shows all the distinctive characteristics of the ancient lacustrine deposits except where modern cultivation has modified the surface of the terrain. In the surroundings of Santa Isabel Iztapan and the neighboring town of Tequisistlán there are plots of maize and vegetables, and some isolated *ahuejote* trees which may indicate the presence of prehispanic chinampas in the region. The noncultivated zones, such as the plain of Tepexpan, are covered by thin, coarse pasture, dotted with alkali spots bare of vegetation.

The most important nearby elevations are located to the north and northeast of the site. These are the hills of Chiconautla and Tlahuilco, formed by volcanic breccia, ashes, and lava flows. Precisely on the slopes of these hills were located the prehistoric shores which correspond to the Pleistocene levels of Lake Texcoco. The hill of Chiconautla with an elevation of 2630 m. forms the eastern margin of the "bottle-neck" which still connected the lakes of Texcoco and Xaltocan in colonial times.

The courses of the present streams in this zone empty into the lake toward the west and southwest of Santa Isabel Iztapan and are not of permanent character. Most of them are branches of the delta of the Río San Juan, and they are known by the names of Río Iztapan, Río Nexquipayac, and Río Nuevo from north to south, respectively. None of these channels, however, pass sufficiently near the site of the mammoths at Iztapan to alter, or to have altered in any form, the stratigraphy resulting from the slow deposition of mud in the lacustrine depths. This circumstance, as will be seen later, is important in connection with the position of the mammoth remains.

The remains of both Iztapan mammoths were located considerably farther into the lake basin than the site of Tepexpan Man. Toward the end of the Pleistocene, in the times when the pachyderms were hunted, the lake margins must have been more than 3 km. beyond the present town of Santa Isabel Iztapan, toward the north and northeast, on the skirts of the Chiconautla and Tlahuilco hills. In spite of this, the difference in elevation between these shores and the zone of Santa Isabel Iztapan is so slight that the depth of the waters of the

lake at the location of both mammoths must not have been greater than 60 to 70 cm. Near the present town of Tequisistlán and Santa Isabel Iztapan there is a slight elevation of the terrain above the general level of the sloping plain. It is possible, therefore, that during the Pleistocene era there might have existed here a kind of peninsula or tongue of land, more or less firm, from which the hunters could operate with greater ease.

The lake which existed at the time of these hunts must have been that which de Terra (1947: 20) referred to as El Risco Lake III (elevation 2240 m.), and which he considered the one associated with Tepexpan Man as well (de Terra 1949, Table I). This shore of El Risco Lake III has been totally destroyed by erosion in the region of Tepexpan, but its remnants are observed in localities nearby such as at El Risco. On the slopes of the Chiconautla and Tlahuilco hills there remain today only vestiges of the higher, and consequently more ancient shores of the Upper Pleistocene era: El Risco Lake I (2263 m.) and El Risco Lake II (2257 m.), both too elevated to have been contemporaneous with that of Tepexpan Man and the elephants of Iztapan.

Techniques of Excavation. The first fossils were found by José Cortés when deepening a drainage ditch which serves as a boundary for his farm land. This operation revealed, without harming in the least degree, part of the base of the skull and the inferior portion of the alveoli, as well as a small sector of the proximal third of both tusks. From the curve of these tusks, it was known from the beginning that the skull was inverted.

The exploration followed a minutely cautious technique, adapted to the special conditions of the terrain and taking advantage of experience acquired in excavating the first mammoth of Iztapan and other similar works of the Dirección. The procedure is fundamentally the same as that followed with a delicate human burial, giving special attention to control over the geological strata overlying the bones, and to the

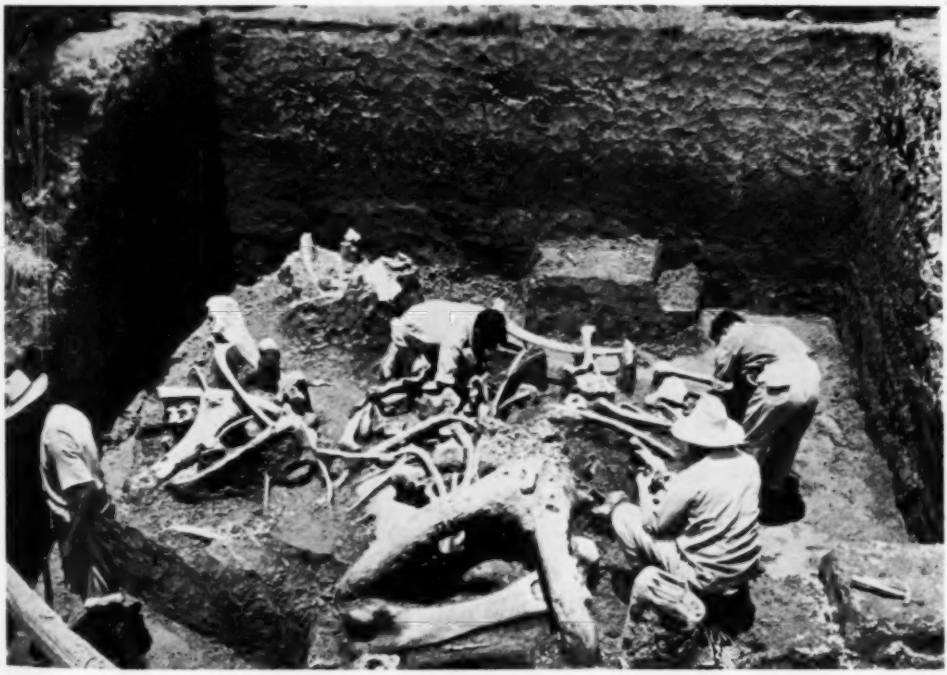


FIG. 2. Excavation of mammoth skeleton in progress.

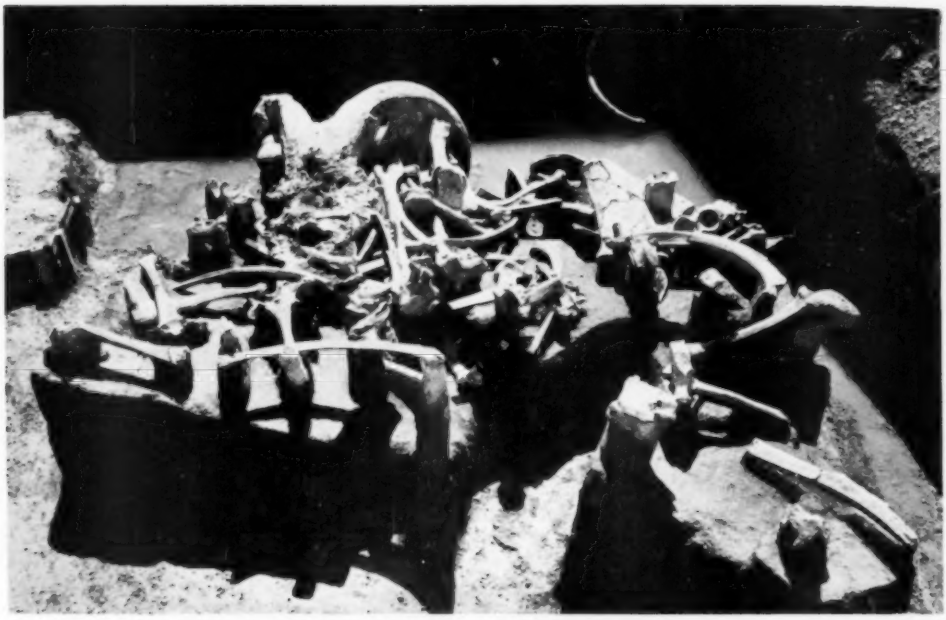


FIG. 3. Excavation of mammoth skeleton completed. Hose for pumping seep water appears at upper right.

search for associated implements which, because of their small size, require very laborious dissection of the deposit surrounding every one of the bones.

The first phase of this work was to discover the maximum area of dispersion of the bones by means of little test trenches. It was soon seen that the greater part of the remains lay to the east* of the skull, so that it was necessary to widen considerably this side of the pit and to cut down a tree in this sector. Without yet deepening the excavation over the area which covered the bones, the 4 walls were made even wider for the double purpose of providing comfortable free space for working around the skeletal remains, and of locating possible additional bones which could be isolated from the principal group (as at Iztapan No. 1). In its final dimensions the pit was 7.05 m. east to west by 5.30 m. north to south.

The next step was to deepen the free area around the skeletal remains up to the 4 walls, which at all times were kept perfectly smooth and vertical, with 90° corners. The pit around the skeleton was deepened to a level much below the bones, so as to leave the whole mass on a bank of clay, a circumstance which permitted greater comfort during the exploration and which made possible the excavation of many little tunnels and bridges around the bones, leaving them in place on pedestals of clay (Fig. 2). These operations were executed with gardening tools, spatulas, needles, and brushes. Shovels and picks were used exclusively for cleaning the pit around the skeleton. The problem of seeping water, which began to appear in abundance around the skeleton when the excavation reached approximately 1.60 m. in depth, was solved by means of a pump.

The Mammoth Remains. The skeletal remains were delimited within an area 3.60 m. north to south by 4.75 m. east to west. The highest bones (the inverted tusks) were found at 1.40 m. below the surface. This level is 20 cm. higher than that of the uppermost bone of the first mammoth at Iztapan (Aveleyra and Maldonado-Koerdell 1952: 14). The remains of the second mammoth, however, were totally included within the lowest geological stratum present, which in this vicinity is a greenish

* This was mistakenly referred to as "west" in the original report, page 12. A.D.K.

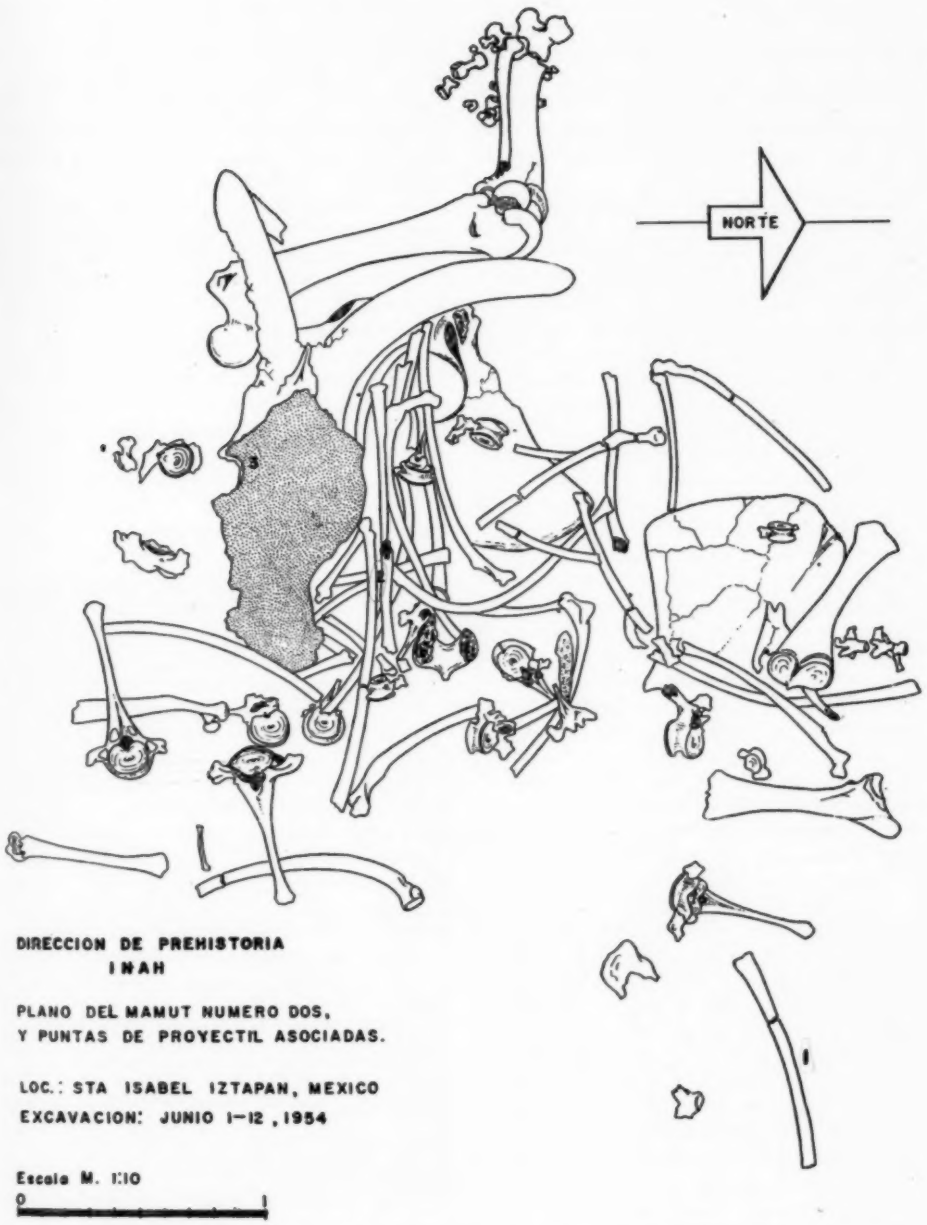


FIG. 4. Ground plan of second mammoth skeleton at Santa Isabel Iztapan. Shaded area represents the broken-off under portions of the skull. The positions of 3 stone artifacts are shown, numbered to correspond to the text.

muck (*limo verde*) belonging to the Becerra formation, the terminal phase of the Upper Pleistocene. The same lacustrine facies of the Becerra formation completely surrounded the skeleton of the first mammoth at Iztapan (Aveleyra and Maldonado-Koerdell 1952: 12-13), as well as the remains of Tepexpan Man when discovered by de Terra and his associates in 1947.

Although the geological deposits at the 2 Iztapan sites are the same, those at Mammoth 2 are less clearly seen than the corresponding ones at Mammoth 1. At Mammoth 2 there is a more gradual transition in coloration and texture of the materials from one stratum to another, which might be due to the fact that this locality is located farther into the ancient lake than the first one, and consequently was subject to more stable conditions of moisture and deposition. Both mammoths, however, lay in exactly the same geological position, completely enclosed within the green muck of the Upper Becerra formation, which lay immediately below a *marshy equivalent* of the Totolzingo formation of the early Postglacial period. In the photograph (Fig. 5 *b*), this deposit can be clearly seen as a black band overlying the lighter colored Becerra formation.

As for the taxonomic classification of the mammoth, the very bad preservation of the upper molars (the only ones recovered), the crowns of which are completely obliterated, does not permit identification of the species. The great robustness and curvature of the tusks suggests, however, that they may belong to an imperial mammoth, *Mammuthus* (*Archidiskodon*) *imperator* Leidy, the largest of the American proboscideans. This suggestion is reinforced on considering that all mammoths discovered up to date in the plain of Tepexpan and nearby places have been identified as imperial mammoths. In an interesting study Maldonado-Koerdell (1955) explains the very probable coexistence of 2 species of mammoth in the Valley of Mexico during the Upper Pleistocene, describing 2 molars of *Mammuthus* (*Parelephas*) *columbi* Falconer in the important prehistoric site of Tequixquiac. According to Maldonado-Koerdell the 2 species had different habitats within the Valley of Mexico; the Columbian mammoth lived on the surrounding elevations covered with forest, and the imperial species on the pastures of the lower plains near the lake.

As to the age of the second mammoth of Santa Isabel Iztapan, the large size of the bones and tusks, the pronounced smoothness of the crowns of the molars, and the complete ossification of the epiphyses of the long bones, indicate that it was an adult animal that had reached the period of maximum growth. The first mammoth of Iztapan was a young animal (Aveleyra and Maldonado-Koerdell 1952: 15-16).

The mineralization of the remains is appreciable although not extreme. The bones show a typical dark coloration which characterizes all the fossil remains which are found in this region, and which is due to the impregnation of mineral salts peculiar to the terrain.

The skeleton was incomplete, lacking some large, heavy parts: the mandible (of which there was found only a small fragment corresponding to the symphysis); both humeri; the right ulna; both radii; the left femur and the right scapula. An inventory of the ribs and vertebrae reveals, on the other hand, that the thoracic box and vertebral column were almost complete. As was said above, the skull was also recovered, with its 2 molars and tusks. Besides this, the pelvic girdle and a great number of additional small bones were present (Figs. 3, 4).

All the bones were found totally displaced and out of anatomical relation, with the remarkable exception of the right hind leg (see below). The scattering of these bones, even more than in the case of the first Iztapan mammoth, must unquestionably be referred to human activity. Displacement by natural agents appears impossible to accept. The stratified deposits around the skeleton reveal only very fine sediment, uninterrupted in deposition and horizontal to the slimes of the lacustrine bottom. This type of deposit can only be the result of a slow sedimentation through several millennia without any violent current which could have moved the bones about, even the smaller ones. On the other hand, disturbances due to predatory animals feeding on the carcass of the mammoth must have been at a minimum as the only carnivorous mammal of any size existing in the Valley of Mexico at that time was the dire wolf (*Aenocyon*) and related forms, the powerful sabre-tooth having become extinct earlier. Even admitting the intervention of canidae and other predatory animals, they could have moved only with great difficulty in water more than a half meter deep.

In summary, it appears definite that the position of the skeletal parts when found was practically the same as that in which they were left by the hunters after cutting up their prey. This leads to a very important conclusion: *Given the geology of a site such as that of the mammoths of Santa Isabel Iztapan, the position of skeletal parts alone is evidence of human intervention in its dismemberment; the hydraulic factors rule out other explanations.*

The story of discoveries related to the geological antiquity of man in America has demonstrated that there exist 4* fundamental types of association between extinct fauna and implements of human origin:

(1) Alluvial deposits in which artifacts and fossils have been transported a certain distance from their original place by a force of water, completely destroying the anatomical relation of the skeletal remains, and where isolated bones of different animals may be mixed in. These associations are usually discovered in the eroded exposures of stream, lake, or aeolian deposits. A typical example is the famous fossil site of Tequixquiac, located just to the north of the Valley of Mexico.

(2) Ancient watering places and other strategic sites at which animals gathered periodically, and where prehistoric man achieved collective hunting (the "butchering grounds" or "kill sites" of North American archaeologists). In these cases there are found masses of fossil bones, many of them broken, in complete disorder and pertaining to dozens of killed mammals. The represented species are usually diverse, and the associated artifacts relatively abundant. Examples of this type of association are some of the more famous sites of primitive man in America such as Lindenmeier, Colorado; Plainview, Texas; Folsom, New Mexico.

* The original report lists 3 types of association: (1), (2), and (4). I have added (3) with the consent of the author. A.D.K.

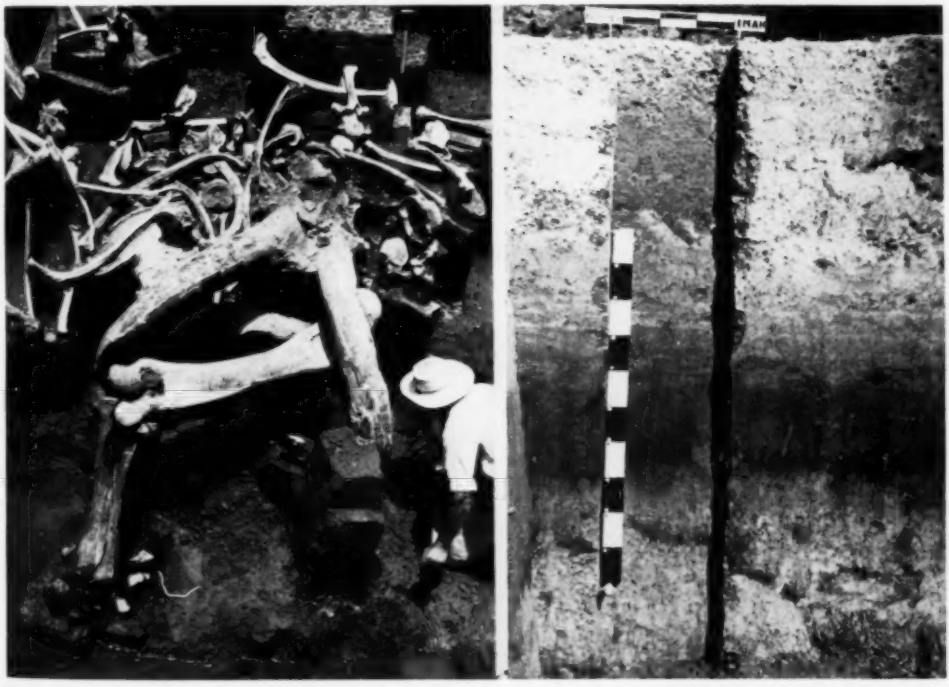


FIG. 5. *A.* View of inverted tusks over articulated right hind leg; the tibia and foot bones at lower left were sunk deeply into the Becerra muck, probably indicating how the mammoth was mired and killed. *B.* Stratigraphic profile of deposits overlying the mammoth remains (see Fig. 9 for explanation).

(3) Caves to which hunters brought parts of slain animals to be further butchered and consumed. Complete disorder and fragmentary representation of different species are also characteristic. Examples are Sandia and Burnet caves, New Mexico.

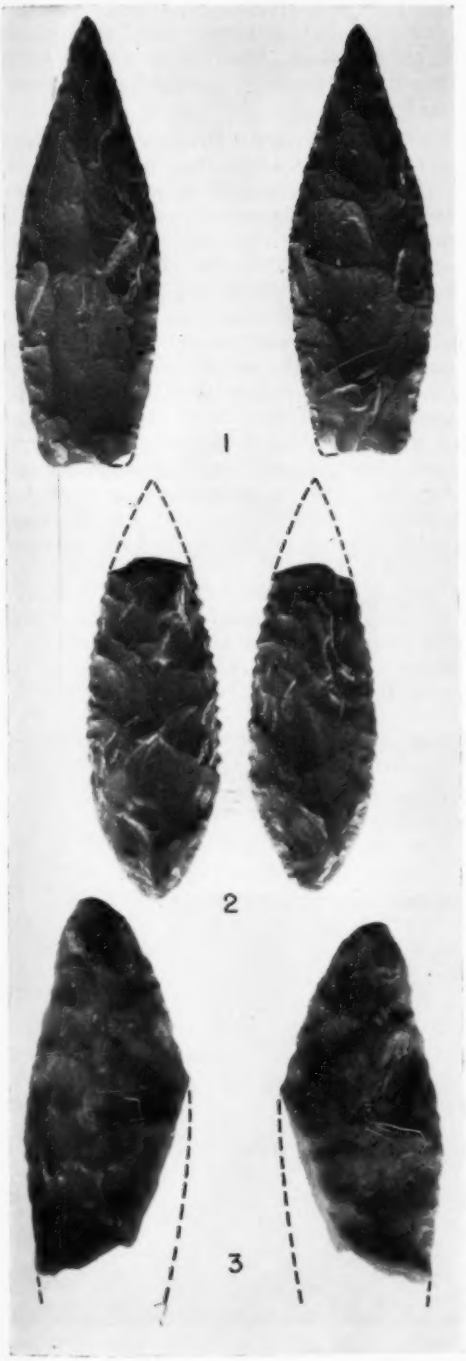
FIG. 6. Section of mammoth rib bearing numerous deep cuts made with stone knife.

(4) Sites in which a single animal was killed and in which, thanks to special geological conditions, the absence of later disturbance has permitted preservation of the remains just as they were abandoned by the hunters. The advantages provided by this last type of association over the 3 preceding ones are obvious, since they can illustrate the hunting customs of prehistoric man in such aspects as the selection of vulnerable points at which to wound the animal, the parts especially selected for food, the techniques of butchering, and so on.

The discoveries at Santa Isabel Iztapan are magnificent examples of this last type of association. The system of exploration used permitted us to keep a detailed record of the exact position of each bone in relation to the others, deriving observations of great interest.

The cranium of the second mammoth, disarticulated and inverted, has special importance. Because of its great weight, this position cannot be attributed to any other factor besides that of human activity. The reason for turning the skull upside down could well have been the extraction of the brain which must have been a favorite delicacy for primitive man. The apparently intentional destruction of the skull base around the occipital foramen seems to confirm this assumption. The skull of one of the mammoths excavated by Arellano (1946b, Figs. 1, 4) in the plain of Tepexpan was found in an analogous position.

The vertebral column and the thoracic box of the mammoth were the parts most minutely dismembered. All the ribs and vertebrae were found dispersed without the least anatomical relationship (Fig. 4). Surely the "loins" and "ribs" of the mammoth were among the parts preferred for food. The limbs were also disarticulated, but in this case many parts were taken away and more widely dispersed. This is especially true of the forelegs, of which only the left ulna was found. The corresponding hind limb was represented by the tibia only. The hind leg, on the other hand, constitutes a remarkable exception from the rest of the skeleton, as it not only was found complete, but also in complete articulation. The proximal end of this limb (head of the femur) rested very near the cotyloid cavity of the corresponding ilium.



In the photograph (Fig. 5 *a*), the way in which this articulated leg lay underneath the inverted skull can be appreciated. Its articulation was probably due to the fact that the leg could not be reached during the task of butchering. The foot of this leg was sunk deeply into the mud, immobilizing the animal; this foot was the lowermost point of the skeleton.

The position of the pelvic girdle and the articulated hind leg provides, besides, the only data suggestive of the probable direction which the animal followed immediately before being trapped in the marsh, toward the east, perhaps trying to reach firm land at the east edge of the lake.

Proof of human intervention in the cutting up of the second mammoth at Iztapan, besides the position of the bones, is provided by the marks and scratches found over many of the bones. Some of these scratches could be attributed to the gnawing of predatory animals, after the carcass was abandoned by man. Nevertheless, there are other marks and cuts which must have been made with scrapers and knives to dismember the carcass. In several European Pleistocene localities, by means of statistical studies based on hundreds of bones found in open sites, shelters, or caves with the deposits of primitive man, it has been possible to prove the *constant* presence of certain kinds of marks and cuts at certain key points where the main muscles and ligaments were attached to the bones, and which had to be cut to achieve an effective dismemberment of the animal. A remarkable study of this kind is that accomplished at the Mousterian site of La Quina (Charente), France (Martin 1910). At some localities in the United States similar investigations have been attempted recently (White 1952, 1953, 1954).

In the case of the second mammoth at Iztapan these marks were found on a large number of the epiphyses or articular facets of the long bones, especially on the head of the only femur, around the fossa of insertion of the so-called "round ligament." These marks have been described by Martin quite often in cases of coxofemoral disarticulation (Martin 1910, Pl. 50, 9, *10*, *11*). There are very frequently also, in cases of intentional skull disarticulation, cuts and transverse grooves over the ridges of the

FIG. 7. Three stone artifacts found in association with second mammoth. Positions are shown in Fig. 4. Dimensions and descriptions are given in the text.

lateral processes of the first cervical vertebra (atlas) of mammals (Martin 1910, Pl. 47, 3, 4, 5). Such marks are clearly observed on the Iztapan mammoth atlas.

Another remarkable object found in the exploration is the rib fragment illustrated in Figure 6. Martin illustrated several cases of incisions on ribs, made, according to him, during the process of defleshing (Martin 1910, Pls. 40-3). However, this fragment of the Iztapan mammoth shows such a quantity of scratches and deep cuts that it is inadmissible that these were simply the result of defleshing a bone. In Figure 6 the front view of this rib shows a series of cuts regular in size and depth, arranged symmetrically on both sides of the ridge. These marks must have an explanation not yet discovered.

Associated Artifacts. During the course of the excavation 3 implements of chipped stone (Fig. 7) were found in irrefutable association with the mammoth remains. Two of them (Nos. 1 and 3) were discovered and photographed in situ. The third artifact (No. 2) was found underneath an aggregate of ribs and vertebrae toward the center of the skeletal remains, while this zone was being explored by means of small tunnels excavated under the bones; therefore, it was not possible to observe its exact location. The position of these implements with respect to the skeleton is recorded in Figure 4.

Artifact 1. This is a lanceolate atlatl (dart) point without shoulders, base slightly concave, and very symmetrically shaped. The edges converge gradually toward the tip and the base from the middle, which is the widest part. Its maximum dimensions are: length 80.2 mm., width 27.4 mm., thickness 8.5 mm. This artifact is skillfully fashioned on both faces from a flake which retains some of the original fracture planes in the middle part of the lower third. It shows pressure flaking, very fine and applied over all of the basal edges, as on most of the early types of projectile points of the Pleistocene and early post-Pleistocene of North America. The tip appears to be somewhat weathered. The material is of igneous origin, probably dacite, of fine texture and dark red color; it is foreign to the Valley of Mexico but abundant in more northern regions, especially the states of Guanajuato and San Luis Potosi. This specimen was found near an isolated rib at the northeastern extreme of the skeletal remains (Fig. 8).

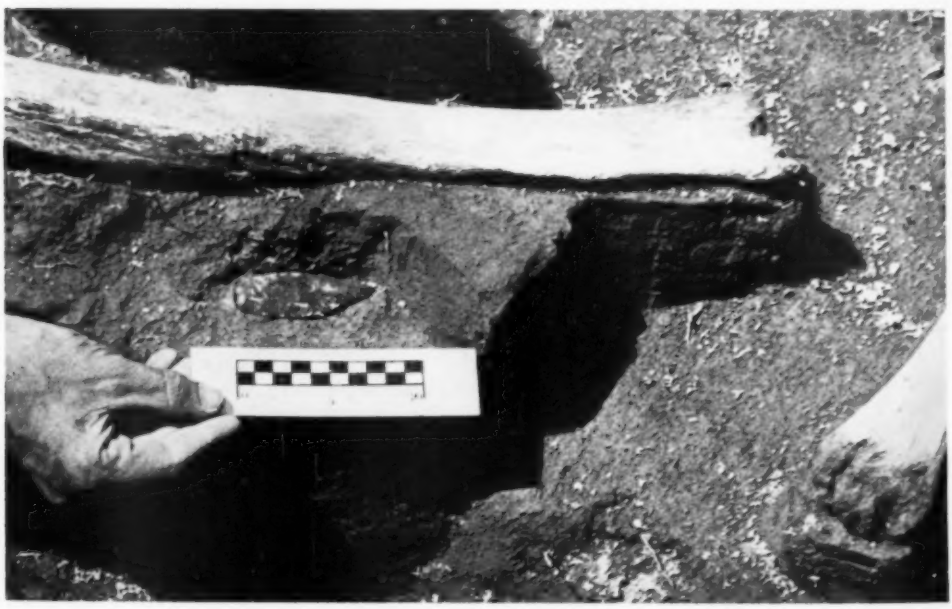


FIG. 8. Artifact 1, a projectile point of Angostura type, in situ.

From the point of view of typology this point is of great importance since it is identified with the recently recognized Angostura type found widely in the Great Plains of the United States. The presence of such points in certain fossil localities of considerable antiquity was pointed out several years ago, but without assigning them a distinctive name (Krieger 1947, Pl. 1 *A, C*). Even earlier, an example was discovered in Texas in apparent association with mammoth remains (Sellards 1940, Pl. 1, 4). In eastern Wyoming very similar points appeared with bones of fossil bison (Anonymous 1943; Wormington 1949: 65). However, the Angostura type was not recognized formally until the excavations of Hughes in the Long site above Angostura Dam in South Dakota (Hughes 1949), where they were found in deposits belonging to the early Postglacial period and initially described as "Long points." This deposit was later dated at 7073 ± 300 years ago by the radiocarbon method (Libby 1955: 126). Similar points have been described from the Agate Basin in Wyoming (Roberts 1951), and from Bexar and Blanco counties in south-central Texas (Orchard and Campbell 1954).

All archaeological data now available tend to place the Angostura type in a *second lithic level* in the Great Plains, which also includes the Plainview, Scottsbluff, Eden, and probably other types (Krieger 1950: 120 and Fig. 8; Suhm, Krieger, and Jelks 1954: 402). Although this period corresponds to the early Postglacial it is very probable that its beginnings were contemporary with the last Pleistocene glaciers. It succeeds the *first lithic level*, called by Sellards (1952: 17) the horizon of the "Llano Man" of which the Clovis fluted projectile point type is characteristic and which is well within the Pleistocene (Krieger 1950, Fig. 8).

The association of an Angostura point with the second Iztapan mammoth is a firm indication of the presence in Mexico of this second lithic horizon of the paleo-Indian cultures in North America. The Plainview point found in Tamaulipas (Arguedas and Aveleyra 1953), and the projectile point related to the Scottsbluff type found with the first mammoth at Iztapan (Aveleyra and Maldonado-Koerdell 1952, Figs. 8, 9; 1953, Fig. 105, *1*), seem to confirm this.

The association of Scottsbluff and Angostura points with the Iztapan mammoths points to a serious problem. When found in the Great Plains with extinct mammals they are invariably associated with fossil bison, a species which may have survived in that region several thousand years longer than the mammoth. The only exception to this rule is at the Buckner ranch, near the Texas coastal plain, where a peculiar mixture of different types of points was apparently associated with remains of several extinct species, including mammoth (Sellards 1940, Pl. 1, *4, 5, 7,* 8). These may now be identified as an Angostura, a Scottsbluff, a Folsom, and the basal fragment of a Clovis point (Suhm, Krieger, and Jelks 1954: 120-1). Aside from this unique case the projectile points discovered with mammoths in the United States have usually been the fluted Clovis, corresponding to the first lithic level already mentioned (Figgins 1931, 1933; Cotter 1937; Bryan and Ray 1938; Sellards 1938; Haury 1953).

Such a situation in central Mexico can be explained in 2 ways: either the Scottsbluff and Angostura points are more ancient and perhaps originated in Mexico, or the mammoth survived in central Mexico after its extinction in most of the United States. Probably the second alternative is the true one.

Artifact 2. The second artifact was found under a complex of ribs and vertebrae toward the center of the remains. It is a projectile point, leaf shaped, made of brown flint of excellent quality. This material is also foreign to the Valley of Mexico. The specimen lacks the distal extremity, which could not be found in the excavation. Originally, the projectile must have been of a laurel-leaf contour, pointed at both ends. The possibility that the missing end was the original *base* of the projectile must be discarded in view of the general contour of the body and the considerable thickness of the fractured cross section, which does not show a gradual thinning to facilitate hafting. The chipping is bifacial, with scars of irregular flakes over both sides and fine pressure flaking along the edges. A remarkable feature is the intentional serration observed on both edges except on the proximal third; this detail confirms that the true base of the projectile is the

lower part as shown in the photographs. The dimensions are: maximum length 61.3 mm., maximum width 24.4 mm., maximum thickness 8.1 mm.

There are no reports to date of the discovery of such double-pointed laurel-leaf projectiles associated with extinct fauna in any site in America.* The form is elementary enough and is found in abundance in diverse cultures of the European continent, in very different chronological horizons. The similarity of this point to the famous "laurel leaves" of the Middle Solutrean of Western Europe is remarkable. This relationship is valid strictly from the typological point of view, without implying a *direct* contact between the paleo-Indian culture and the Upper Pleistocene of Europe. The possibility of extension of the Old World Paleolithic into America is not entirely remote and, at any rate, it must not be discarded a priori. The Solutrean, for instance, has very important foci in eastern Europe and its expansion or influence toward the Asiatic East is possible. The Solutrean shape seems to show in the Sandia type points, the most anciently known so far in America, and is indication enough that infiltrations from the Upper Paleolithic of Eurasia into the New World possibly occurred.** Needless to say, this digression does not pretend to prove a Solutrean affiliation for the second point found with the Iztapan mammoth.

Artifact 3. The third artifact was found in situ approximately underneath the right supraorbital ridge of the inverted skull of the mammoth. In this case the artifact is a biface knife, fashioned from impure flint (chert) of very light color with whitish bands. The shaping was done by percussion completely over both faces, with scars of wide irregular flakes, conditioned perhaps by the poor quality of the material. There is secondary retouching by pressure on some small sectors of the edges. The broken edge coincides with an increase in thickness of the artifact near the middle, and as the breakage is very ancient, it might have happened during the original shaping process. It is probable that the knife originally was of laurel-leaf form with both ends pointed. In its present state the artifact measures 67.2 mm. in length, 34.9 mm. in maximum width, and 9.3 mm. in thickness.

It is evident that this object could never have been destined to be a projectile point, considering its general size, thickness, and irregularity of flaking. Typologically, it is a simple knife which, even after breakage, could still have been used effectively for cutting up the mammoth. The place in which it was found, underneath the skull and near the atlas, could indicate that it was one of the implements used in the complicated task of disarticulating the cranium of the animal. The presence of scrapers, knives, and other cutting implements was also abundantly proved in the exploration of Iztapan Mammoth 1.

Summary. The little "industry" of Santa Isabel Iztapan, found with the 2 mammoths in identical stratigraphic position, scarcely 400 m. apart, provides no less than 10 artifacts. Of these, 3 are projectile points, each of a distinctly different type (Scottsbluff, Angostura, and "laurel-leaf"). This mixture of types in association with isolated remains of extinct animals is almost unique in North America. The great majority of such finds have demonstrated strict uniformity in associated points, as in the recent discovery at Naco, Arizona, of a mammoth with 8 Clovis points (Haury 1953). The only exception known to me besides that of Iztapan is the Buckner site in Texas already mentioned.

The typology of the more ancient lithic industries of Central Mexico is still extremely confused and full of all those unknowns typical of the regions in which prehistoric investigation is barely being started.

* This statement is true for association with extinct fauna. However, in Suhm, Krieger, and Jelks 1954, p. 440 and Pl. 99, we described and illustrated the bipointed *Lerma* type first recognized by R. S. MacNeish in southern Tamaulipas. Its distribution was given as western, coastal, and southern Texas in addition to Tamaulipas, and its age estimated as "several thousand years before the Christian era." A.D.K.

** The idea that *Sandia* points can be derived from the Upper Paleolithic of the Old World has already been noted by Bosch Gimpera (1948: 6-8), who relates them with the Gravettian "notched points" which also persisted in the Swiderian stage in Poland. The *Gravettian* and *Swiderian* points, however, are unifacial and very distinct from the bifacial *Sandia* points, which are much more nearly parallel to the "notched points" of the Upper Solutrean. A.D.K.

Estratigrafía del sitio delMamut Nº 2

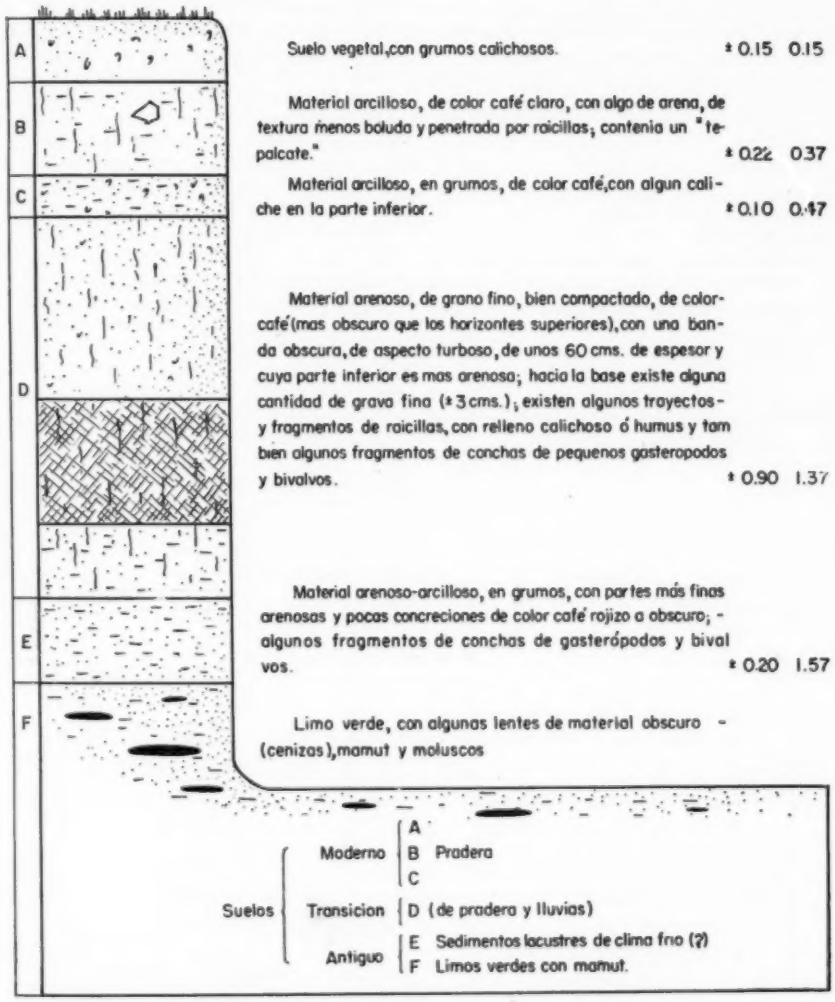

A
B
C
D
E
F
Suelo vegetal,con grumos calichosos. ± 0.15 0.15
Material arcilloso, de color café claro, con algo de arena, de textura menos boluda y penetrada por raicillas; contenia un "tepalcate." ± 0.22 0.37
Material arcilloso, en grumos, de color café,con algun caliche en la parte inferior. ± 0.10 0.47
Material arenoso, de grano fino, bien compactado, de color-café(mas obscuro que los horizontes superiores),con una banda obscura,de aspecto turboso,de unos 60 cms. de espesor y cuya parte inferior es mas arenosa; hacia la base existe alguna cantidad de grava fina (± 3 cms.); existen algunos trayectos-y fragmentos de raicillas,con relleno calichoso ó humus y tam bien algunos fragmentos de conchas de pequenos gasteropodos y bivalvos. ± 0.90 1.37
Material arenoso-arcilloso, en grumos, con partes más finas arenosas y pocas concreciones de color café rojizo a obscuro; -algunos fragmentos de conchas de gasterópodos y bivalvos. ± 0.20 1.57
Limo verde, con algunas lentes de material obscuro -(cenizas),mamut y moluscos
Suelos
Moderno
A
B Pradera
C
Transicion
D (de pradera y lluvias)
Antiguo
E Sedimentos lacustres de clima frio (?)
F Limos verdes con mamut.

FIG. 9. Stratigraphic column at the site of the second mammoth of Santa Isabel Iztapan. The mammoth was associated with Stratum F, the green muck (*limo verde*).

APPENDIX ON STRATIGRAPHY

MANUEL MALDONADO-KOERDELL

The site of the second Iztapan mammoth is located on the plain left by Lake Texcoco, in its northeast portion, when it retreated westward. The geographical position of this site is more western than the first Iztapan mammoth and, consequently, when the ancient lake covered it this site was deeper under the water. This is an important detail, which contributes toward explaining some little differences in stratigraphy and supports certain paleo-ecological deductions. At the present time, the terrain is used for milpa agriculture, but it is interesting that around the second mammoth there is an abundance of *huejotes* trees (*Salix bonplandiana*) in rows, a sure indication of native chinampa gardens in not very ancient times.

The stratigraphic column at the excavation of the second mammoth is shown in Figure 9. Comparing this column with that at the site of the first mammoth, one notices a greater thickness of the Postglacial sedimentary materials, which measure 1.37 m. as against 0.95 m. at the site of Iztapan Mammoth 1. Also, the different strata are better defined, showing with greater precision the 2 edaphic developments which have taken place during the last 10,000 or 12,000 years. In fact, Horizons A, B, and C correspond to modern soil, of dry to subhumid climate and pasture vegetation (when agriculture is not practiced). Horizon D corresponds to a marshy bottom in which a transition soil originated, in a rainy (or more humid) climate with prairie vegetation, conditioned in its development by the oscillations of the retreating lake; however, the band of peat indicates a period of certain permanency in the waters.

Possibly, Horizon C corresponds to the lower part of the "zona Iluvial" of Bryan (1948), with accumulation of a certain amount of calcium carbonate (represented by the fine basal deposit of caliche), originating in a hot climate. In this case Horizon D would correspond to the "zona vadosa" of Bryan, always saturated with water which maintained continuous vertical oscillations, due to the presence of a mantle of surface water under much more humid climatic conditions. Such conditions would have created this transitional soil, essentially immature, or even perpetually "young," which Bryan describes as typical in the lower Recent of marshes which occasionally dried.

At their contact, there is no well-marked distinction (as in the case of Mammoth 1) between Horizon D and the Becerra formation (Horizon E). Farther down in the Becerra lithological characteristics separate these horizons more clearly, since Pleistocene material acquires a certain lumpy texture with concretions which contrasts with the granular texture and brown color of the younger Horizon D. Besides, the little root channels found higher do not reach the Becerra formation, although at both

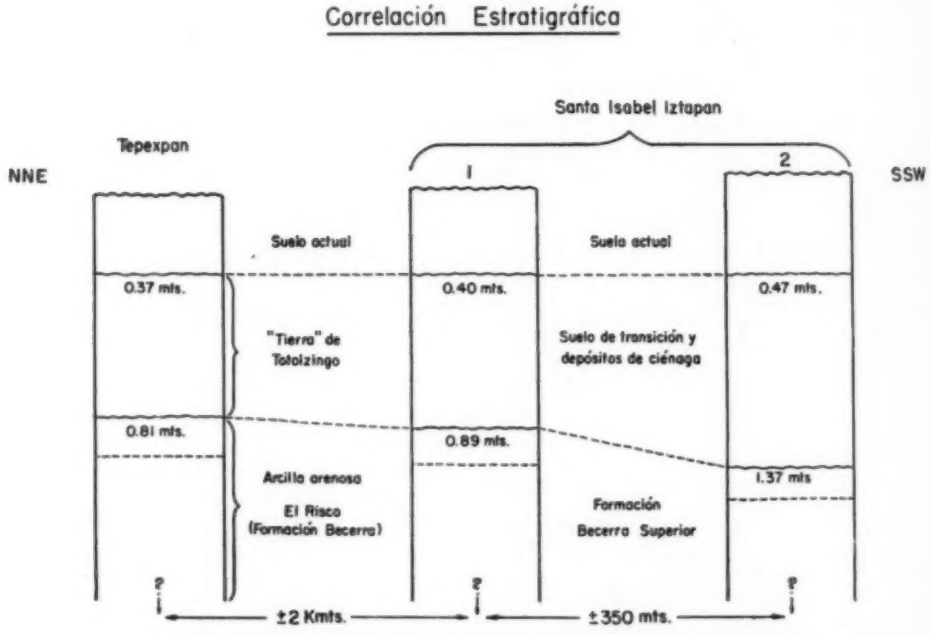


FIG. 10. Stratigraphic correlation chart for the site of the human skeleton at Tepexpan and the 2 mammoths at Santa Isabel Iztapan.

levels there are fragments of gastropod shells and lacustrine bivalves. The lower part of the Becerra formation (Horizon F) has a strong proportion of bentonitic material which gave rise in places to lenticular inclusions of black color. This deposit contained the mammoth remains and corresponds to the level of "green slimes," as in the case of the first mammoth at Santa Isabel Iztapan.

This stratigraphic column, as well as others studied in the Valley of Mexico, reveals fluctuations in the course of the last 15,000 years. It may be estimated that, from bottom to top, Horizons E to A indicate, with some fluctuations, a general tendency toward greater dryness and higher temperature from the beginning of the Recent up to the present, accompanied by retreat of the lake. Horizon D, alternatively under water or dried, reflects these variations in its composition, and toward the end comes to be more altered because of being in the zone of maximum saturation, for through it all the dissolved salts from the upper zones pass, with much oxygen and carbon dioxide. It is possible that the fine caliche deposit of Horizon C corresponds to the Postglacial arid climate, which culminated about 7000 years ago, ending the edaphic process with Horizons B and A.

Horizons E and F correspond to the lacustrine facies of the Becerra formation and were deposited by a complex mechanism of fluvial dragging and aeolian transport, but in a continuous manner and under water of rich organic content. At certain periods of the Upper Pleistocene there was a mixing of abundant ashy materials from the nearby volcanoes (in this case possibly the Tlahuilco, less than 2 km. north, which maintained its activity up to recent times), giving rise to this fine bentonitic deposit with scattered dark lenses where the skeletal remains were contained. The bentonitic characteristics of this lacustrine facies of the Becerra formation is one of the most typical features of the late phases of the Upper Pleistocene in Central Mexico. This volcanic activity took place within a climatic framework of greater humidity (with high lake levels) and lower temperature (with typical vegetation).

Figure 10 presents a correlation of stratigraphy in the 3 localities which thus far have rendered the most important prehistoric materials in the Valley of Mexico: the site of Tepexpan Man, and the 2 Iztapan mammoth sites.

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THE MELHADO SITE, A HOUSE MOUND GROUP IN BRITISH HONDURAS*

GORDON R. WILLEY AND WILLIAM R. BULLARD, JR.

THE MELHADO site is near the town of El Cayo, in the Cayo District of west central British Honduras. This region forms a part of the eastern edge of the Petén forests. Its limestone hills and ridges are covered by a dense jungle growth, including such typical trees as the mahogany, sapodilla, Spanish cedar, and cahune palm. Rainfall is heavy, amounting to 50 to 70 inches a year at El Cayo, most of it falling in the rainy season from June to October.

Archaeologically, the Cayo District also ties to the Petén. Present information indicates that the ancient occupation extended from Early Formative (Mamom) through the Classic (Tzakol and Tepeu) periods. Ceremonial centers, typically located on hilltops or ridges, consist of temple pyramids and palace type buildings compactly grouped around plazas. The corbeled vault, plain and carved stelae and altars, and ball courts are reported from several ruins in the District. In addition to these more spectacular sites, milpas and other clearings have shown the countryside of the Belize River Valley to be dotted with small, inconspicuous mounds of the kind which we will describe from the Melhado site. Many of these may be presumed to be the remains of domestic house platforms. The limited excavations carried out at the Melhado site, and the more extensive explorations at Barton Ramie (Willey, Bullard, and Glass 1955), support this interpretation.

The extensive explorations of Thomas Gann provide a background for the archaeology of British Honduras (Gann 1894-95, 1896-97, 1918, 1925). The well-known ceremonial center of Benque Viejo, or Xunantunich, near the Guatemalan frontier and about 6 miles southwest of El Cayo, was visited and described by him as well as by Maler (1905) and by Tozzer and Merwin. A good many years later J. E. S. Thompson excavated at Benque Viejo (Thompson 1940), and he related the ceramic stratigraphy at that site to other British Honduran and Petén sequences. Still later, A. H. Anderson, the present Archaeological Commissioner of the Colony, Linton Satterthwaite, Jr., and Michael Stewart carried out additional work at the same site in clearing a number of architectural features (Satterthwaite 1951). Other significant archaeological surveys and site explorations in British Honduras are reported upon by Thompson (1931, 1939) near Mountain Cow, some 25 miles south of El Cayo, and at San José, about the same distance north of El Cayo. The archaeology of both of these is closely related to Benque Viejo, and it also bears upon the test excavations at the Melhado site reported upon here. Similarly, the studies made by Satterthwaite (1951) at Cahal Pech (less than a mile distant from the Melhado site), the explorations of William and Michael Coe (1956) at a small site midway between El Cayo and Benque Viejo, the work of Ricketson (1929) at Baking Pot (about 6 miles east of Cayo), and the various surveys of A. H. Anderson provide additional background data for the Melhado site investigations.

In February of 1953, while on a reconnaissance trip of the Belize Valley and the El Cayo region, the authors had the opportunity to visit the Melhado farm and were permitted to map and explore the small mound cluster revealed by the agricultural clearing. This was done over a period of 4 days, from February 14 to 17. We are indebted to the owner, Henry Melhado of Belize, for permission to do this and to Arthur Mapp, manager, for his many courtesies during our stay. Linton Satterthwaite, Jr., accompanied by Jeremiah Epstein, directed us to the site and both of them gave generously of their time to assist in our work there. We wish to express our gratitude to these colleagues.

It should be mentioned that our interest in this particular mound group was prompted by the fact that we were looking for Maya house mounds. This survey was in connection with a larger and long-term program of study and excavation of prehistoric Maya domestic sites and settlement patterns. Such a program was inaugurated by the Peabody Museum, Harvard University, under the senior author's direction, in the following year, 1954. In 1953 the senior

* This paper was presented in modified form at the Annual Meeting of the American Anthropological Association, Tucson, Arizona, December, 1953.

FIG. 1. Map of the Melhado site.

author was traveling under the auspices of the Peabody Museum and the junior author under those of the Department of Archaeology, Carnegie Institution of Washington.

The significance of prehistoric settlement pattern study in the Maya lowlands is obvious. At the present time most of our archaeological information from this region has been derived from ceremonial center sites. This has revealed the amazing architectural, artistic, and intellectual achievements of the Classic Maya but has given little indication of the size and disposition of the actual populations which sustained these centers. The above-mentioned program has as its objectives the determination of the nature, numbers, grouping, and relationships to ceremonial centers of Maya domestic sites throughout the Formative and Classic occupations of the Belize Valley of what is now British Honduras. It is hoped that such basic data will give new insights into problems of prehistoric agriculture and land utilization and, indirectly, the perplexing question of the apparent abandonment of the lowlands at the close of the Initial Series period.

The Site and Surroundings. The Melhado site lies ½ mile northwest of the outskirts of the town of El Cayo on the Macal River. The fork where the Macal and Mopan join to form the Belize River is between 1 to 2 miles north. The site is a cluster of small, grass-covered mounds, standing on the edge of the second terrace above the flood plain of the river and overlooking the first terrace on which modern El Cayo is built. To the south, the terrain rises gradually to a high flat-topped hill about a mile away, upon the summit of which, overlooking El Cayo and a great expanse of surrounding country, is the ceremonial center of Cahal Pech. This is the nearest ceremonial center to the Melhado site, and, despite its proximity to El Cayo, it has remained unknown to archaeologists until recent years. It is composed of pyramids, palace type mounds, and a ball court, grouped around a series of rectangular courts. Plain stelae are also reported, and test excavations by Satterthwaite (1951) have revealed an occupation running through the entire Classic period as well as ceramic hints of earlier periods. The proximity of the Melhado site to Cahal Pech suggests that the former was probably included within the orbit or sustaining area of the latter, being a domestic community supporting and owing allegiance to this center.

The Melhado farm, an agricultural and livestock establishment, is an extensive clearing on the first and second river terraces. Within the clearing are plowed fields, orchards, pastures, and corrals. The bluff which forms the edge of the second terrace and is about 6 m. high cuts across the clearing from north to south. The terrain both above and below the bluff is almost perfectly level and, except in the plowed fields, is covered with a grassy turf.

The 13 mounds which compose the site — as we have surveyed it — are scattered among the buildings of the farm establishment and in the fields around them. Their arrangement is shown in Figure 1. It will be noted that there is no formal layout. The greatest concentration occurs near the terrace edge, but mounds also spread out to the northwest. The only mound visible within the clearing which was not included on the map is Mound 12, which lies 130 m. due north of Mound 10. Two of the mounds, Numbers 1 and 7, are distinguished from the others by their larger size and apparent complexity of construction. They seem to form a nucleus for the site, as it were, about which the smaller mounds cluster.

It must be pointed out that our knowledge of the size and extent of the mound group is limited to what can be seen within the clearing. We know that the fields on the first river terrace below and to the east are devoid of ruins. The western limits of our little mound group are also reasonably certain since, with the exception of an area of bush near Mound 11, the clearing extends for 100 to 200 m. west of the mapped area without disclosing additional mounds. The northern and southern boundaries, along the second terrace, are much less definite. The forest begins about 50 m. south of Mound 5, and, on the north, there is a strip of jungle that comes to within 50 m. of Mounds 8 and 9. West of this jungle strip, a cleared field reaches for 150 m. north of Mound 10, with Mound 12 at its extreme northern edge. It is, thus, possible, indeed probable, that additional mounds lie scattered through the bush both to the north and south of the site as known. Nevertheless, enough area is exposed to strongly suggest that a distinct mound clustering does occur in the vicinity of the farmhouse.

FIG. 1. Map of the Melhado site.

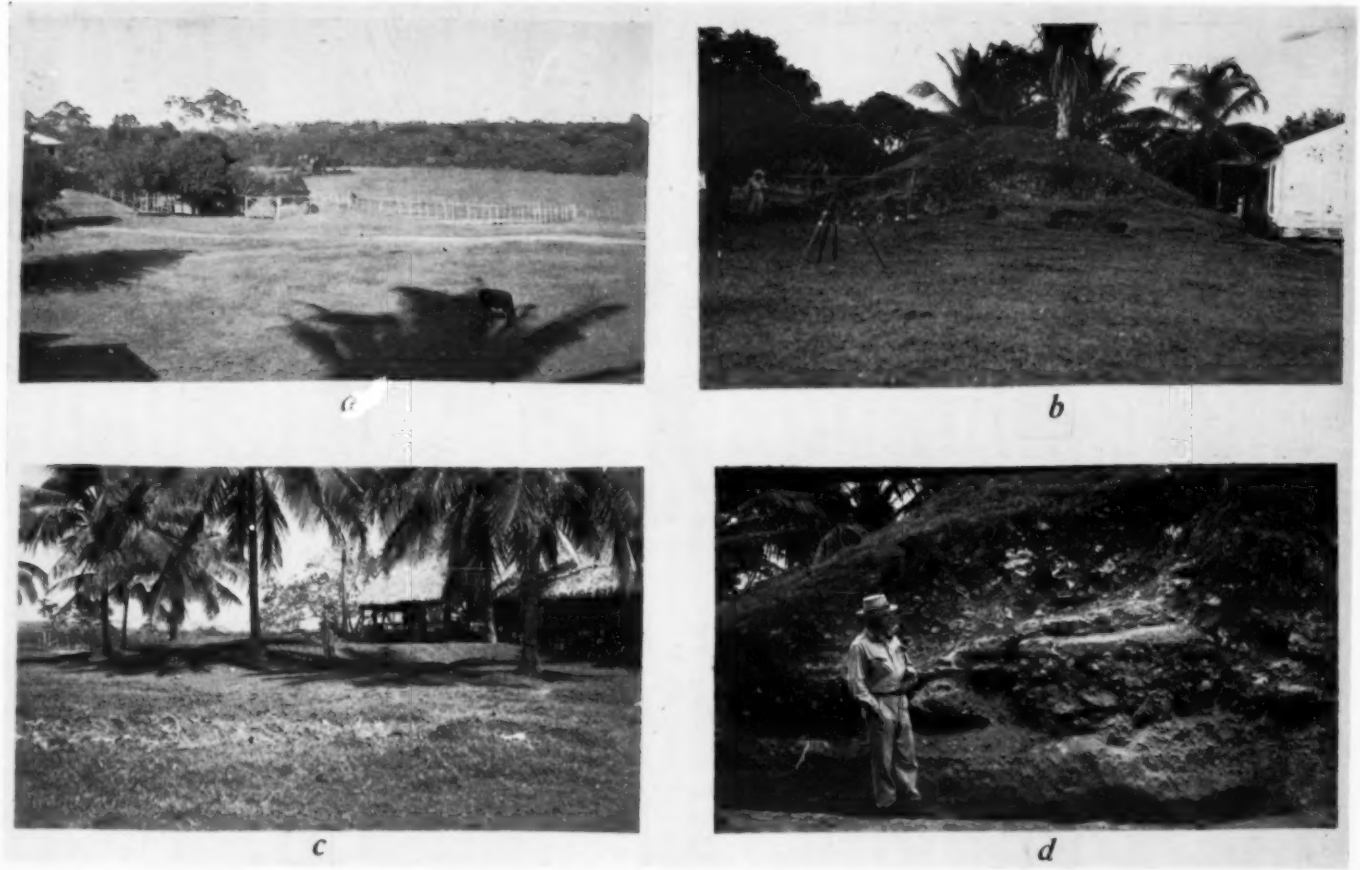

FIG. 2. Views of the Melhado site: *a*, looking northeast from Mound 1 with Mound 3 in center foreground and lower river terrace in background; *b*, Mound 1, from east, showing old excavations; *c*, Mound 7 from south; *d*, cleared profile on east face of Mound 1, showing edge of stone platform with mound fill above and below.

Mound 1, from east, showing old excavations; *c*, Mound 7 from south; *d*, cleared profile on east face of Mound 1, showing edge of stone platform with mound fill above and below.

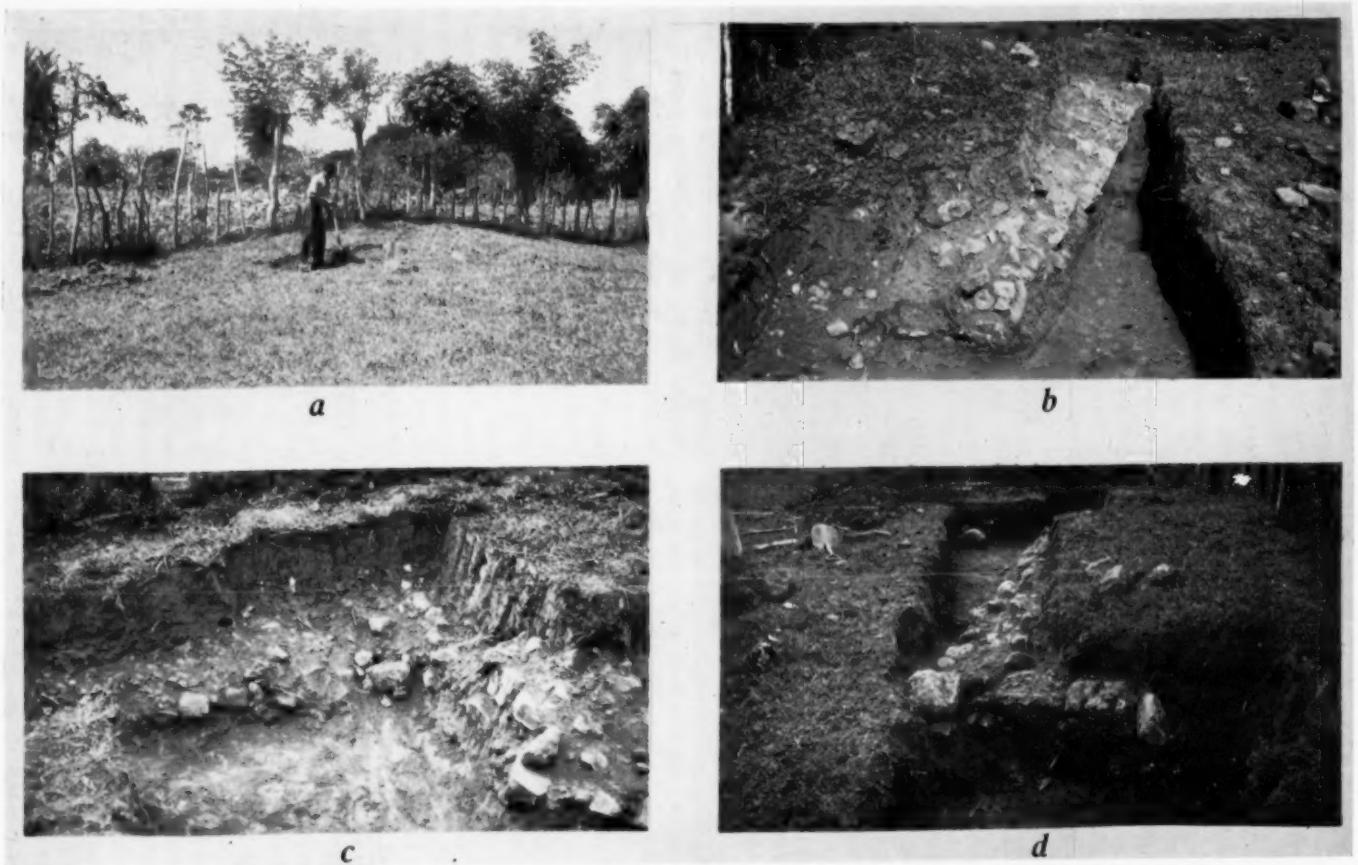

FIG. 3. Views of the Melhado site: *a*, Mound 5, from east, at start of excavation; *b*, looking northeast along stone retaining wall of house platform; *c*, looking west into corner formed by main platform and terrace or ramp; *d*, looking south at the northeast corner of retaining wall.

Unfortunately, very little is known of the distribution, numbers, or concentrations of similar small mounds in the immediate environs of the Melhado site or the town of El Cayo. We know that the first river terrace level in and around El Cayo is without mounds; however, on the outskirts of the town, where the modern road to Succotz climbs up onto the second terrace, 2 or 3 little mounds may be seen in among a settlement of native houses. These mounds are about ½ mile south of the Melhado site. Some 300 to 400 m. closer to the Melhado site, and also on the second terrace edge, there are 1 or 2 mounds near the Cayo hospital. Such occurrences suggest that small groups of mounds may run for considerable distances up and down this second river terrace below Cahal Pech.

To return to the Melhado site, Mound 1 is its outstanding feature (Fig. 2 *b*). It measures 25 by 20 m. in diameter and is over 4 m. high. Its relatively large size and conical shape set it apart from the other structures and suggest its probable ceremonial or community function. The other 12 mounds, in contrast, are low oval or rectangular platforms which may reasonably be supposed to have served as substructures for dwellings of wood and thatch.

Mound 7 is of particular interest and importance (Fig. 2 *c*). While its exact construction is concealed by a mantle of topsoil, it seems to consist of a basal platform or terrace 25 by 15 m. across and 50 cm. high upon which stand 3 smaller platform structures averaging about 5 by 3 m. across and 50 cm. high. The small structures are placed in a rectangular arrangement, as around a little court. The east edge of the basal platform was cut away to make room for one of the farm buildings, revealing under the topsoil a tight fill of small stones.

The remaining mounds are nearly all of simple oval or oblong plan, oriented uniformly with their long diameters northeast-southwest. Conditions of preservation vary. Those on which we could obtain accurate dimensions range from 8 to 14 m. in length and 5 to 10 m. in width, with the average about 9 by 6 m. Height varies from 30 cm. to 1 m. Mounds 2, 3, 4, 5 and 11 show the least disturbance due to farming activities. They are all covered by a thick turf which hides their constructional details. We selected Mound 5 for a test excavation and, upon cutting into it, discovered a stone filled platform 30 to 40 cm. beneath the surface sod (see below).

Over half of Mound 6 was removed to make way for the construction of the farmhouse. Arthur Mapp, the farm manager, says that stone tools and sherds were found at the time of the destruction. Near the east end of the remaining portion can be seen what looks like part of a stone retaining wall.

Mounds 9 and 10 are located in a plowed field. It is of interest that the plowed soil over the mounds is distinctly more reddish in color than the soil in the surrounding field. In places the plow has brought to the surface small stones, such as might compose a platform fill, but it is doubtful whether the plowing has gone deep enough to seriously damage the interior construction of the mounds. A considerable number of flint chips was found on the surface of both mounds, but only on Mound 9 were there sufficient sherds to warrant making a collection.

Mound 13, on the very edge of the bluff, is strictly speaking not a mound at all. It lies across a trail used by livestock in passing from one pasture to another and its outlines and form are completely obliterated. Its location is known only by a localized concentration of sherds and chips on the edge of the bluff and in the slope wash below. There is no evidence for a stone-filled platform such as some of the other mounds apparently contain. We were able to obtain a sherd collection here. Mound 8 has also been badly damaged by livestock and it was only with difficulty that we could trace its outlines, which seem to have been L-shaped.

Mound 12 was discovered after the mapping of the site was completed. It lies 130 m. north of Mound 10, in an area overgrown with weeds. In size and orientation it conforms with the other small mounds.

Excavations in Mound 5. It was decided to make a test excavation in one of the mounds in order to obtain a subsurface pottery sample and also, in the brief time available, to gain some notion of the type of construction to be expected in the small mounds. Mound 5 (Fig. 3 *a*) was selected because it seemed better preserved than many and also because it was in a location where digging would not damage the sod near the farm buildings.

The mound is oval in shape, 13 m. long by 9.5 m. wide, and oriented with its long axis approximately east-west. It rises to a maximum height of 95 cm. in the center. A fence line crosses the mound, separating the western two thirds, which are in a squash field, from the eastern part, which is covered by turf and shows no sign of disturbance of any kind.

A north-south trench, 9.5 m. long and 1 to 2 m. wide, was run across the eastern end of the mound. It disclosed the east edge of a stone platform (Figs. 3 *b*; 4 *a*) and also the edge of what appears to be an extension onto the south side of the platform. The structure was entirely covered by 30 to 40 cm. of grayish turf. Its base rested upon a red soil which must represent the ancient ground surface. Sherds were abundant in the lower part of the turf, especially along the platform edges, but disappeared in the upper centimeters of the underlying red soil.

The main platform was 30 to 40 cm. thick, the fill consisting of a rubble of small stones mixed with earth. Retaining walls were found on the north and east sides but not on the south.

The east retaining wall, 4.2 m. long, had slumped outward (Fig. 3 *b*). It consisted of a row of roughly shaped stones averaging 30 cm. long, 12 cm. wide, and 14 cm. high. The wall had originally been 2 courses high, but nearly all of the second course had toppled over. A later stone fill had been laid east of the retaining wall, covering and concealing it. It was only when we cut into this fill to obtain a pottery sample that the wall was disclosed. The later fill was composed of rather large stones which had been piled up against the east side of the retaining wall. Among these stones was a broken shallow-trough metate. Smaller stones were used toward the eastern edge of the fill; and although we did not attempt to follow out the complete extent of the fill, it seemed to disappear within a meter of the retaining wall. It is probable that the retaining wall had begun to slump over while the structure was still in use and that the fill outside and wall was placed there in order to prevent complete collapse. Many sherds were found throughout the fill and a mano and a spherical hammer stone were recovered from its base on the underlying red soil.

The retaining wall on the north side of the platform was composed of larger stones and totaled about 25 cm. in height. It ran for only 1.5 m. west of the northeast corner (Fig. 3 *d*) of the platform, at which point there seems to be another corner. Due to the short time available we were unable to explore further to see whether the wall line actually does turn south at this point, as seems likely.

We found no retaining wall on the south end of the platform. About 50 cm. west of the south end of the east retaining wall we struck the edge of what is possibly a low terrace or ramp abutting against the main platform (Fig. 3 *c*; 4 *a*). This edge we followed for nearly 3 m. south, from whence it curved away to the west. It, also, had no retaining wall although the edges were fairly sharply defined. The stones forming the fill of this extension were somewhat smaller than those in the fill of the main platform. The thickness of the fill was about 20 cm. where it joined the main platform but it thinned out gradually towards the south.

During excavation, we separated sherds and artifacts from the north and south halves of the trench, from the soil outside the platform edges, and from the stone fill which had been placed against the east retaining wall. These lots were analyzed separately, but since no significant differences could be determined between their contents and since the nature of the construction revealed in the excavation does not seem to justify a separation, they are tabulated below as a unit.

Excavations in Mound 1. Mound 1 of the Melhado farmhouse group lies on the edge of a little grove of trees, about 50 m. from the Mound 5 just described. The size and shape of Mound 1 suggest that it had a special, central significance. Whereas Mound 5, and the other low mounds of similar contour, are believed to be the foundations of former domestic dwellings, it is assumed that Mound 1 was a small pyramidal structure built, presumably, as the base for a temple. The present dimensions of Mound 1 are 25 m. north-south by 20 m. east-west, and its summit rises 4.54 m. above the surrounding flat. The mound is now oval in outline although it may once have been rectangular and oblong. A small flattened area at the top may be the remnant of a former platform, but, in general, the conformation of the mound is simply that of a steep hummock whose original form is difficult to estimate. Except for the old excavation to be described,

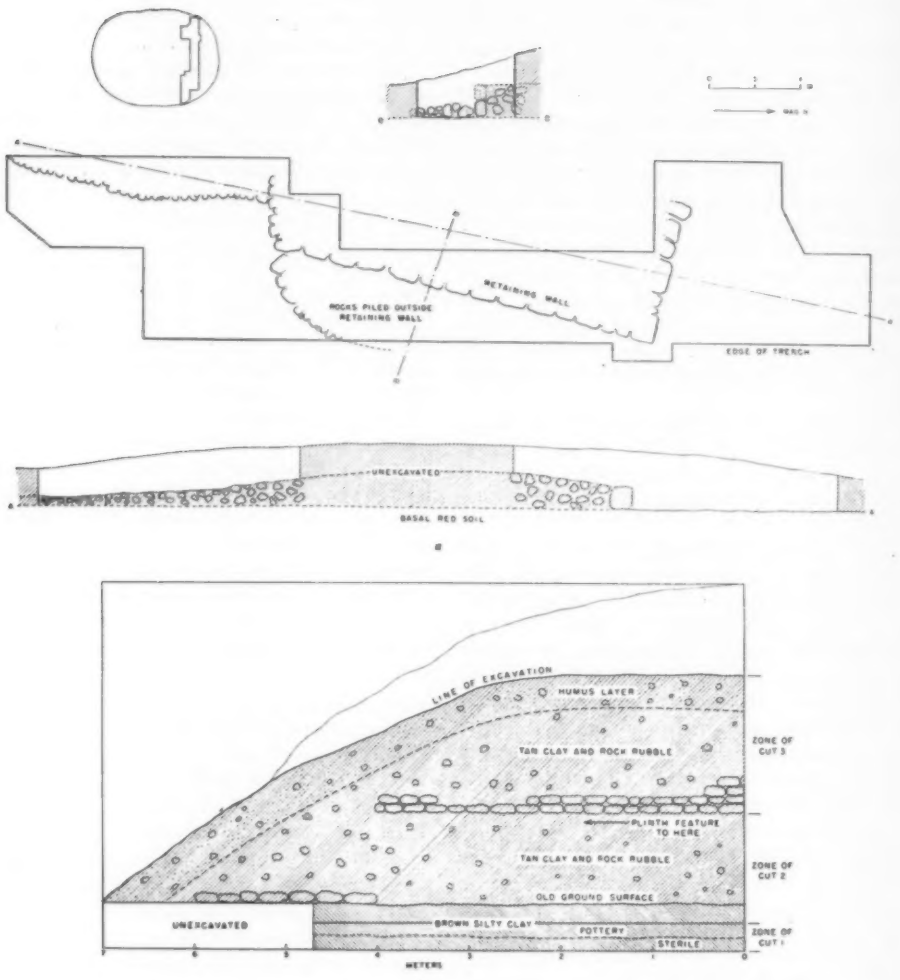

FIG. 4. Plans and cross sections of Mounds 5 and 1: *a*, Mound 5 plat diagram (upper, left), east-west trench cross section (upper, right), trench plat diagram (center), and north-south trench cross section (bottom); *b*, profile of east face of portion of Mound 1.

the mound was covered with an earth and grass cover in the early months of 1954 (Fig. 2 *b*).

Along the east side of Mound 1, at the south end, a small excavation had been made for the purpose of obtaining dirt fill for use on the farm. This old excavation had cut away an approximate ⅛ of the mound and revealed a partial profile of the mound construction. In order to study this profile, and to obtain a pottery sample from the mound, it was decided to trim the mound face of the old cut and to dig into the mound base at the bottom of the excavation. These minor excavations were carried out concurrently with the work on Mound 5.

Cut 1 was laid out as a trench 1.00 m. wide and 4.70 m. long, the long axis paralleling the exposed mound face on a north-south line. Before beginning the digging, the surface of the ground in this cut, which was exposed brownish colored clay, was carefully cleared of potsherds and other objects. It was the purpose of Cut 1 to obtain a pottery sample from the old ground level, or the basal subsoil, which once underlay the artificial body of the mound. The clearing of the ground before excavation eliminated from this provenience any sherds or artifacts that might have fallen into the old excavation from the exposed face of the mound fill.

The Cut 1 excavation was removed as a unit. It began on what appeared to be about the approximate ground level surrounding Mound 1 and was carried down for a total depth of 30 cm. (Fig. 4 *b*). In the upper 15 cm. of the cut the soil removed was a silty red-brown clay, stained with charcoal and other organic matter. Numerous sherds and small rocks were mixed through this soil. In the lower 15 cm. of the cut the clay was cleaner in appearance and contained no pottery. This last was, apparently, the soil corresponding to the clay underlying and surrounding the house platform of Mound 5. On the termination of Cut 1, and following a cleaning of the mound profile, it could be seen that the cut had actually begun about 20 cm. below mound base. That is, the excavation of Cut 1, in addition to the old excavation, revealed a total of 50 cm. of soil below the base of the obviously artificial earth fill of the mound. The top 35 cm. of this basal soil showed sherds and refuse disturbance; the lower 15 cm. did not.

After the completion of Cut 1, additional excavation was carried into the exposed profile of the mound proper. The soil and structural cross section showed the following features (Fig. 4 *b*). On the brown silty clay of the old ground level was a 90 cm. stratum of tan clayey soil and angular rocks. Toward the south edge of the cut a row of rough limestone blocks had been placed on the old ground surface, but these stones did not extend for any appreciable distance. On top of the 90 cm. stratum of tan soil and rock fill was a double row of roughly dressed limestone blocks (Figs. 2 *d*; 4 *b*). This double row averaged about 30 cm. in thickness, and the individual stones that composed it measured about 25 by 15 cm. on their exposed faces. Toward the north, or the center of the mound, the lower row of stones projected out some 10 to 15 cm. beyond the upper row to effect a plinth or basal molding. This plinth does not extend for the full length of the double row of stones but only for about 2.00 m. from the north end of the cut. On top of the double row of stones, at the extreme north end of the cut, there are other similar stones in position. These may be the remnants of an upward continuation of the wall or mound facing which is now represented by only the lower rows of stones, or, possibly, they may be the end of a transverse wall foundation which runs on an east-west line. Above the double row of stones, which marks a mid-point in the mound construction, there is more tan soil and rock fill. The profile shows 1.30 m. of this material over the stones, the upper 50 cm. or so being stained with humus. This cross section does not, of course, give us a full story of the construction as higher portions of the mound center were untouched by the old excavation.

During our cleaning excavations of this profile, 2 more provenience units were established. Cut 2 was a sample of soil, rock and potsherds taken from just below the double row of stones or from what might be considered the "lower fill." Cut 3 was another sample taken from just above the stones, from the "upper fill." In both cases sherds were saved from a section about 50 cm. in diameter and about 50 cm. in depth (back into the profile).

Still another provenience for pottery and artifacts was registered for a "surface" collection of materials gathered from around the immediate environs of the mound. It is likely that these were fragments tossed out of the old excavation, and as such, they may come from any mound or submound depth.

CERAMIC AND ARTIFACT ANALYSES

Pottery Descriptions

A total of 1789 sherds have been tabulated from our test diggings at the Melhado site. Perhaps 100 or so very small and eroded fragments of pottery were recovered in addition to these but were discarded as very badly damaged or eroded. The greater portion of our tabulated collection came from the Mound 5 excavations, but a reasonably large pottery sample was also obtained in the profile cleaning and digging in Mound 1. Small surface collections were also picked up from Mounds 9 and 13.

Much of the pottery from the Melhado site shows weathering. This is particularly true of the material from Mound 5, as it was found at very shallow depths, and of the surface sherds from Mounds 9 and 13. The pottery in the best state of preservation came from Mound 1—both from the old ground surface beneath the mound and from mound fill. There seem to be 2 reasons for the Mound 1 pottery being less eroded than the other ceramic samples from the site. First, it was protected by being covered with deep earth deposits; second, much of it was of a strikingly different ware quality from the Mound 5 material. As will be seen further along, most of the Mound 1 sherds are earlier types than the bulk of the pottery which we found at the site.

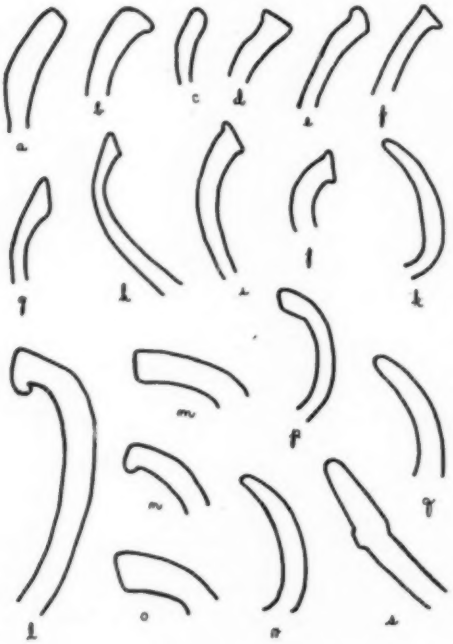

Fig. 5. Rim profiles of Fugitive-Black Ware, Melhado site (interiors to right): *a-f*, incurving bowls with flat lip; *g-j*, incurving bowls, beveled lip; *k*, storage jar (tuff temper); *l*, large vessel, outcurving rim; *m-o*, late storage jars; *p-r*, early storage jars; *s*, lateral ridged dish.

In describing and identifying this material we are relying heavily upon the pottery type descriptions provided by J. E. S. Thompson from Benque Viejo (Thompson 1940). Supplementing these are additional ceramic descriptions from San José, British Honduras (Thompson 1939). We also gratefully acknowledge the help of R. E. Smith, Carnegie Institution, who examined this material in detail. In general, the Melhado pottery is very similar to the Benque Viejo material. This, of course, is to be expected in that the 2 sites are only 6 miles apart and on the same river system.

Our pottery descriptions are organized under the headings of "wares," following Thompson. Some of these wares, such as "Fugitive Black Ware" and "Red Ware" (see Table 1), are subdivided into a number of "types." Some of the "types," as the *Incurving bowl with flat lip*, are comparable to pottery types as these have been formulated in the archaeology of the southeastern or southwestern United States in that they are assemblages or clusterings of a number of modes, that is, bowl form, black pigment, lip form, temper, and so on. Others among the "types" are really single modes, that is, annular base, or treatments comprising 2 or 3 modes. These differ from the types in that the criteria that are inherent in them are insufficient to reconstruct a complete pottery specimen; yet such "modes" and "treatments" often have diagnostic chronological value. The concept of a pottery mode is defined by Rouse (1939); the use of the term "treatment" in this special sense is after Phillips and Williams (personal communication, 1955). There are other logical inconsistencies in the classification in that while most of the "types" have descriptive names there are others that are designated by chronological or culture period terms. Thus, within the Fugitive-Black Ware group we have the "types" *Late storage jars* and *Early storage jars*. Following Thompson's definitions and stratigraphy, one is characteristic of the Benque Viejo IV period, the other of Benque Viejo III.

It should also be noted that our first group of "wares," as these are listed in Table 1, belong, essentially, to the Maya Late Classic period as defined at Benque Viejo, San José, Uaxactun, and elsewhere. These "wares" are comprised of "types" that fall into the Benque Viejo III-IV (Tepeu) time ranges. This includes the *Fugitive Black Ware*, the *Red Ware*, the next listed *Unslipped Ware*, the *Buff Ware, incised*, and *Red-and-black*, *Red-and-black-on-orange*, and *Black-on-cream*. Following these on Table 1, such "types" as *Red ware, basal-flanged bowl*, *Unslipped ware, basal-flanged bowl*, *Red ware, Chicanel style*, and so on, pertain to the Early Classic (Benque Viejo II, or Tzakol) or Formative (Chicanel and Mamon) periods. The fact that some of them are designated as "Red ware" implies no close historical relationship to the category of "Red Ware" types of Late Classic times.

Finally, it will be seen that the overwhelmingly large part of the Melhado pottery falls into the "types" (categories would be a better term) of *Residual Red Ware* and *Residual Unslipped Ware*. Over 1550 of the 1789 sherds are so classified. Most of these are small body sherds or eroded sherds which could not be identified more exactly. A great many of them, particularly the red slipped material, is tuff tempered. We are inclined to think that most of this residual pottery falls into the Late Classic bracket although earlier sherds may be mixed through the residual lots.

Fugitive-Black Ware. Over 50 of the Melhado sherds fall into this major group. In surface appearance and texture the Melhado pottery matches the Benque Viejo descriptions, and within this ware we note about the same range of vessel forms listed by Thompson from Benque Viejo. Comparisons were also made using Thompson's Benque Viejo collections which are now stored in the Peabody Museum, Harvard University. Thompson's descriptions from Benque Viejo apply to the Melhado pottery (1940: 6):

> It has a dull finish, approximates Blackish Slate, and wears off very easily, leaving a smoothed body surface (Cinnamon) or a reddish buff surface. . . . Only very occasionally does the original black slip still remain on the greater part of the surface. In most sherds of this type it adheres only to quite small areas, giving a mottled appearance, and in many it is entirely worn (not flaked) off. Apart from its dull finish, this black slip is also distinguishable from the polished black in that the color is uniform and reddish or orange patches never occur. It is also noteworthy that it is almost invariably associated with calcite temper (very rarely with quartz or quartz-and-calcite temper) but never with tuff temper, and with forms most likely to be of local manufacture.

TABLE 1. POTTERY SHERDS FROM THE MELHADO SITE BY TYPE AND PROVENIENCE

Types	Provenience							Totals
	Mound 5	Mound 1, Cut 1	Mound 1, Cut 2	Mound 1, Cut 3	Mound 1, Surface	Mound 9	Mound 13	
Fugitive-Black Ware:								
Incurving bowls with beveled lips	8					1		9
Incurving bowls with flat lips	18					2	1	21
Large vessels with outcurving rims					2			2
Late storage jars (calcite temper)	4							4
Storage jars (tuff temper)	6					1		7
Early storage jars	12					2	1	15
Lateral ridged dishes	2				1			3
Annular bases	1							1
Incised decoration	1							1
Solid handles or lugs (calcite temper)	2							2
Red Ware:								
Flat based bowls or cups	8							8
Tall cylindrical vases	5							5
Incurving dishes	19		1					20
Tau-footed tripod dishes	3							3
Tau-footed tripod pans	2							2
Oven-footed tripod pans	21							21
Jars	2							2
Lateral ridged dishes	4			1				5
Outturned rims	6							6
Tau-foot supports	1							1
Oven-foot supports	2						1	3
Ring base temper)	12							12
Ring ba (calcite ... ter)	1		1	1			2	5
Unslipped Ware:								
Storage jars	17					1		18
Craters	3							3
Buff Ware, incised	4							4
Red-and-black-on-vinaceous tawny:								
Bowls	1							1
Barrel shapes	1							1
Red-and-black diagonal grooved tripod plate						2		2
Red-and-black-on-orange	3							3
Black-on-cream	5							5
Miscellaneous:								
Hollow figurine (?)	1							1
Residual Red Ware	190	24	9	5	2	14	1	245
Residual Unslipped Ware	1020	55	38	56	13	50	32	1264
Red Ware, basal-flanged bowl						2		2
Unslipped Ware, basal-flanged bowl	1			1				2
Red Ware, Chicanel style	1	10	2	1	2			16
Unslipped Ware, Chicanel style		6	9	3			1	19
Red Ware, fine incised	1							1
Unslipped Ware:								
Small dot punctated		1						1
Brushed		1		1		1		3
Fingernail punctated				3				3
Lid			1					1
Rocker-stamped decoration		1						1
Mars Orange Ware	2	4	2					8
Polished Black Ware	4	15	2	5		1		27
TOTAL SHERDS								1789

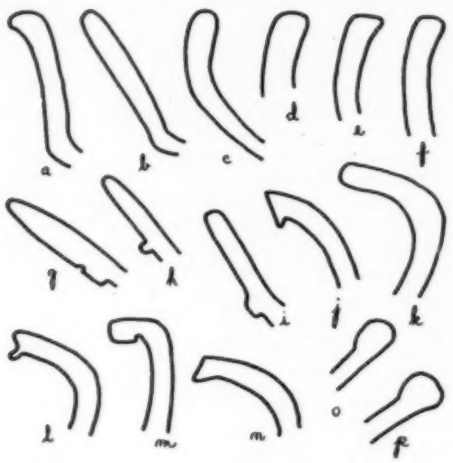

FIG. 6. Rim profiles of Red Ware and Unslipped Ware, Melhado site (interiors to right): *a-i*, Red Ware; *j-p*, Unslipped Ware; *a*, *b*, oven-footed tripod pans; *c-f*, incurving dishes; *g-i*, lateral ridged dishes; *j-n*, storage jars; *o-p*, graters.

The one exception to this at the Melhado site is the type, *Storage jars (tuff temper)*, which is represented by 7 sherds. All of the other vessel form types in Fugitive-Black Ware are calcite tempered.

The types of Fugitive-Black Ware include *Incurving bowls with beveled lips*, *Incurving bowls with flat lips*, *Large vessels with outcurving rims*, *Early storage jars*, and *Late storage jars*. These are Thompson's (1940) types, Numbers 26, 50, 53, 28 and 52, respectively. Rim profiles of these types, as represented at the Melhado site, are shown on Figure 5. The remaining Fugitive-Black types at the Melhado site are not represented at Benque Viejo. These include the *Storage jar (tuff temper)*, the *Lateral ridged dish*, an incised sherd, an annular base fragment, and 2 long solid handles. The incised sherd bears a panel-type design in which one band or zone, set off by deep incised lines, is painted black. An opposing zone without pigment is filled with small incised rectangles enclosing incised X-marks. The annular base fragment is small, but it came from a flared base at least 3 cm. in height. The solid handles average 2 cm. in diameter and 5 cm. in length. They appear to have been portions of straight handles to vessels.

Red Ware. This category of Red Ware at the Melhado site (Fig. 6) embraces the various Late Classic (Benque Viejo III and IV) types which Thompson (1940: 6-7 and type descriptions) has described individually and also characterized as a whole. Both tuff and calcite tempering materials are recorded although the majority of the Red Ware at the Melhado site is tuff tempered.

The type *Tall cylindrical vases* (Thompson 1940, No. 19) is represented by only 5 sherds from the Melhado site. All of these are flat bases which show a right angle, or near right angle, juncture of base and vessel wall. All are tuff tempered. The type *Incurving dishes* (Thompson 1940, No. 18) is represented by 20 rim sherds. Most of these show red pigment on both surfaces, and where the surface has been preserved it is well polished. Several sherds have one or 2 horizontal incised lines just below the rim. All are tuff tempered. The type *Tau-footed tripod dishes* is detected from 3 sherds, none of which show the actual foot supports; however, Thompson's (1940, No. 5) illustrations of sherds with similar punctated decoration and heavy, notched basal-angle ridges indicate this to be the proper classification of the 3 sherds in question. These pieces are also tuff tempered. *Tau-footed tripod pans* (1940, No. 16) are indicated in the same manner. The 2 rim sherds in the Melhado collection bear a deep encircling incised line just below the lip. This, and their silhouettes, imply the tripod pan type. One sherd is calcite or grit tempered; the other tuff tempered. The 21 sherds of the type *Oven-footed tripod pans* are also identified from rim and basal-angle features by analogy with Thompson's (1940) type Number 47. All are tuff tempered. The types *Jars* and *Lateral ridged dishes* are represented by 2 and 5 fragments, respectively. The jar pieces are from vessels with relatively small orifies. Both types are tuff tempered.

The remainder of our Red Ware "types" have no exact parallels in Thompson's Benque Viejo classifications. The *Flat based bowls* or *cups* are base sherds on which the angle of the wall slopes outward rather than upward at a 90° angle. These could be cups or bowls,

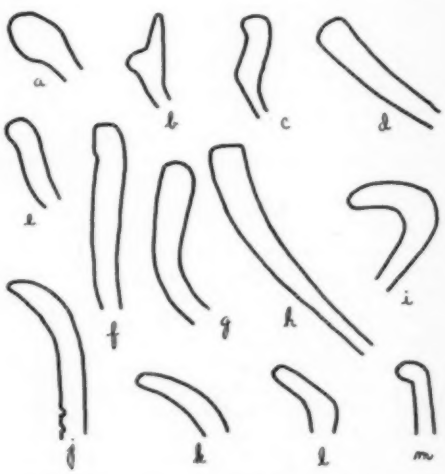

FIG. 7. Rim profiles of Chicanel and Mars Orange wares, Melhado site (interiors to right): *a-f*, Red Ware; *g-i*, *k*, Unslipped Ware; *j*, *l*, *m*, Mars Orange.

but they may be pieces of barrel-shaped vessels. *Outturned rims* are simply direct rims which slant or flare very slightly outward. Sherds of this type are all tuff tempered. These may be small fragments of tripod pans or dishes which cannot be identified more closely, or they may be rim pieces of cups and bowls. *Ring bases (tuff temper)* are probably base portions of Red Ware dishes such as Thompson (1940, Nos. 11, 13, 14) illustrates from Benque Viejo. Diameters of the rings appear to be in the range of 8 to 10 cm. The ridges of the rings are narrow (about 5 mm.) and low (5 mm. or less). Ring bases (calcite and grit temper) may in some cases belong to the late Red Ware category, but others may be Early Classic pieces. *Tau-foot supports* and *Oven-foot supports* are, obviously, from types with podal appendages of these forms; but, from the size of the fragment, the type identification cannot be narrowed down further.

Unslipped Ware. Unslipped pottery of late provenience includes *Storage jars* (Thompson 1940, No. 6) and *Craters* (Thompson 1939: 114). The identification of the calcite tempered *Storage jars* is clear cut, with the Melhado forms (Fig. 6) matching those from Benque Viejo. The *Craters* are represented by only 3 sherds in the Melhado collection. All three of these appear to be sand or grit tempered, and all of them appear to be pieces of bowls or jars on which the incurve to the orifice was somewhat more pronounced than in the crater form illustrated by Thompson from San José. It is to be noted that this crater form is not reported from Benque Viejo.

Buff Ware, Incised. There are 4 sherds, none of them rims, which bear deeply incised or carved designs, fine crosshatched incised backgrounds, or dot punctate fillers. They are buff in color, although it is possible that black pigment has worn off some of them. All are tuff tempered. They are similar to the "Carved and Painted (Tuff Tempered) Buff Ware" and "Black Punctate Ware" (Thompson 1939: 108, 121), Late Classic types from San José.

Two and Three Color Wares. The polychrome type, *Red-and-black-on-vinaceous tawny*, is represented by a barrel shape and a bowl sherd (see Types 35 and 36 in Thompson 1940 for Benque Viejo similarities). *Red-and-black-on-orange* apparently, similar to polychrome from Benque Viejo (Thompson 1940, No. 34), is seen in 3 Melhado site sherds. There are also 2 fragments of *Red-and-black diagonal grooved tripod plates.* This type, according to R. E. Smith (personal communication), has a Tepeu 2, or middle Late Classic appearance in the Petén. The same chronological value is also placed upon 5 sherds of *Black-on-cream.*

Residual Wares. These have been discussed above. It is likely that most of these sherds belong to the Late Classic period.

Basal-flanged Bowls. These horizon markers for the Early Classic are 4 sherds, two in red ware and two seemingly unslipped. It is possible, however, that one of the latter may be an eroded polychrome piece.

Red Ware, Chicanel Style. The 16 sherds of this type include several rims (Fig. 7), some basal-angles, and flat bases. This type from the Melhado collections conforms closely to the San José I Red Ware (Thompson 1939, see Figs. 24, 25, 27, 28).

Unslipped Ware, Chicanel Style. These 19 specimens were tentatively identified as Chicanel by R. E. Smith. Globular jars with short flaring collars are well represented in the collection (Fig. 7; see R. E. Smith 1936, Chicanel figure, Nos. 1-4). Bowls are also represented (Fig. 7).

Red Ware, Fine Incised. A single sherd of this type, calcite tempered, may be the same as the sherd illustraed by Thompson (1940, No. 5 *k*). If so, it is identifiable as Benque Viejo Ib, or Chicanel.

Unslipped Ware, Miscellaneous. A small dot punctated sherd is reminiscent of similarly decorated material from Benque Viejo Ib (Thompson 1940, No. 5 *i*). Sherds with *Brushed* or striated surfaces may be of comparable age; however, we have noted that this technique is most common in the Early Classic period at the Barton Ramie site, some 7 miles downstream from the Melhado site. Three *Fingernail punctated* sherds may belong to Formative period, although this is not certain. One very thin sherd from a beaker or bowl bears zigzag rocker-stamped designs on its exterior surface. These are arranged vertically, extending down from the lip. This piece, although showing no slip at present, may have been red slipped or may have had only a smoothed or polished buff surface. The rocker-stamped technique is usually a Late Formative period marker in Middle American series.

Mars Orange. This is another tentative identification made by Smith. The 8 sherds in the Melhado collection (Fig. 7) do not duplicate, exactly, the Mamom period type but they very closely approximate it.

Polished Black Ware. Some of these 27 sherds, judging from shoulder angles, are Chicanel. Others may be considerably later. It is probably a mixed lot of material. Most of the sherds are rather thin. About half bear interior as well as exterior polishing. There is one small, solid, rounded foot support.

Other Artifact Descriptions

Metate. A large fragment of a shallow trough-shaped metate was taken from the platform fill on the east side of Mound 5. The fragment is 28 by 18 by 7.5 cm. The complete artifact was probably only slightly larger. The base of the metate is convex and shows very little smoothing. The upper surface is concave, well-smoothed, and carefully shaped. The edges have been dressed along the top. In over-all conformation the metate was boat-shaped with ends slightly narrower than mid-point measurement. The material is limestone.

Mano. A mano stone of fine-grained igneous rock also came from Mound 5. One end has been broken away. The length is 21 cm. and maximum width and thickness at center, 7 and 5.3 cm., respectively. One

surface is smoother and flatter than the other three and is obviously the grinding surface. The implement has thinned and tapered rounded ends.

Bark Beater. A rectangular bark beater of limestone measures 9 by 7 by 3.4 cm. It is slightly broader (7 cm.) at one end than the other (6.1 cm.). The corners are rounded, and a hafting groove encircles the artifact. Striations on one flat surface average 4 mm. apart and are slightly finer than on the opposite surface where they average 6 mm. apart. These striations on both surfaces are parallel to long axis of stone. The artifact was found near Mound 6 by Arthur Mapp.

Briquettes. There are 3 small briquettes of red-burned clay, one of which shows an impression of a pole about 2 to 3 cm. in diameter. Two of these briquettes came from Mound 5 and one from Mound 1, Cut 3.

Figurine Fragment. This object is also listed on the pottery table. It is a small piece of what appears to have been a rather large, hollow figurine. It is painted red and white, and there are vague suggestions of black pigment which may have indicated the features of a human or animal face. It came from Mound 5.

Stalagmite Section (?). A columnar piece of white limestone, about 8 cm. long and 5 cm. in diameter, came from Mound 1, Cut 1. It may possibly be a fragment of an artifact, but, more likely, it is a section broken from a stalagmite or stalactite.

Chipped Stone. An obsidian flake blade, 3.8 by 1.1 cm., came from Mound 5. In addition, the following chipped stone tools, or fragments, came from this same mound: a section of a long blade or lance point of chert, bifacially worked; 3 plano-convex chert scrapers which are about 3.5 cm. in diameter and 1 cm. in thickness and which show slight retouch chipping; 2 sidescrapers, both about 5 cm. in length, 3 cm. in width, and 1 cm. or more in thickness, which have been primarily chipped and then retouched along the long sides; and one midsection of a chipped ax which in its original size was about 20 cm. in length.

A sidescraper, 8.4 cm. in length, but of the same type as the two from Mound 5, came from the surface collection of Mound 13.

Miscellaneous chert flakes showing use nicking came from Mound 5 and Mound 1.

Trapezoidal Stone. A trapezoidal stone of argillitic material came from Mound 5. This object measures 5.4 by 3.4 by 1.1 cm. and has been shaped only by grinding along the 2 long sides.

Discussion of Provenience and Period. The pottery collection from the Melhado site represents a chronological range beginning in the Formative and extending through the Late Classic. There is little doubt that the spot had been a Maya habitation site for many centuries.

Late Classic or Tepeu phase pottery is best represented, and the largest collections of these late types come from the excavations in Mound 5, presumably a small house platform tumulus. Two late horizon marker types are in the Mound 5 collections. One, *Fugitive-Black Ware, Incurving bowls with beveled lips,* is characteristic of the Benque Viejo III period (Thompson 1940, No. 26). The Benque Viejo III period (including the *a* and *b* subdivisions) appears to correlate with the Petén Tepeu 1 and 2 periods. The other type, *Fugitive-Black Ware, Incurving bowls with flat lips* (Thompson 1940, No. 50), is confined largely to the Benque Viejo IV period, corresponding to Petén Tepeu 3. In the Mound 5 collections at the Melhado site the earlier beveled lip type totals 8 sherds, the later flat lip type 18 sherds. This would indicate an occupation of the mound as a house platform through most of the Late Classic, particularly from Benque Viejo IIIb into IV. The storage jars of Fugitive-Black also show this same dating. Both "Early" and "Late" jar types are present in Mound 5, arguing for use of, or refuse deposition upon the location, throughout the equivalent of Benque Viejo III and IV periods. Among the Red Wares *Tall cylindrical vases* (Thompson 1940, No. 19) and *Tau-footed tripod dishes* (No. 15) are found at Benque Viejo in Periods IIIa and IIIb; however, the 2 Red Ware types with the highest frequencies of occurrence in Mound 5, *Incurving dishes* and *Oven-footed tripod pans* (Nos. 18 and 47) have Benque Viejo IIIb and IV assignments. *Unslipped storage jars,* of which a good many were found in Mound 5, are most common in Benque Viejo in period IV (Thompson 1940, No. 6). On the other hand, the *Vinaceous tawny* types, of which only 2 sherds occur in Mound 5, are placed as Benque Viejo IIIb. For the most part, types earlier than Late Classic are not found in Mound 5; however, it will be seen in Table 1 that one basal-flanged sherd, one *Chicanel* sherd, and 2 fragments of what appears to be *Mars Orange* are in the Mound 5 collections.

The identificable pottery from Mound 1, is *Chicanel, Mars Orange,* and *Polished Black Ware.* Sherds of this latter ware probably belong to the Formative periods. From Cut 2 of Mound 1 the sherds fall into the same early groups except for 2 Red Ware fragments that are probably Late Classic. The Cut 3, Mound 1, provenience again shows a collection that is largely Chicanel except for a basal-flanged sherd, a *Red Ware, lateral ridged dish,* and a ring base. Few sherds were identifiable in the

Mound 1 "surface" collection, and these are divided between Late Classic and Chicanel types.

The small lot of material from the surface of Mound 9 is divided between Late Classic and Early Classic types, and the equally small collection from Mound 13 surface is Late Classic except for a possible *Unslipped Chicanel* sherd.

To sum up, Mound 5 was occupied most intensively in the Late Classic or Tepeu period, particularly in Tepeu 2 and 3 which are the approximate equivalents of Benque Viejo IIIb and IV. It seems most likely that the stone-edged platform which the test excavations disclosed was constructed during this time, probably in the Benque Viejo IIIb interval. A scattering of earlier sherds, Early Classic (Tzakol or Benque Viejo II), Chicanel (Benque Viejo Ib), and Mamom (Benque Viejo Ia), were also turned up in the excavations; but as we have recovered these earlier materials elsewhere on the site, it is not surprising that occasional stray sherds are found in this particular excavation. It is unlikely, however, that the stone platform of Mound 5 was built in any of these early ceramic periods. Mound 1, the pyramid, was constructed upon an old Chicanel occupation level, but there are insufficient sherds to date the construction of the mound proper. The *Lateral ridged dish* piece from Cut 3 implies that this portion of the mound was not constructed until the beginning of the Late Classic (Tepeu 3 or Benque Viejo IIIa); but, admittedly, the evidence is very skimpy. The very small collections from Mounds 9 and 13, and their surface proveniences, are inadequate for dating.

Summary. On the second river terrace above the Macal River, near El Cayo, British Honduras, there is a small group of prehistoric mounds in the Melhado farmhouse clearing. This mound group, the Melhado site, lies within an area 250 by 150 m. in extent. There are 13 mounds in the group and these are arranged random fashion along the terrace. The limits of the site are not fully known. To the north and south the second terrace is covered with dense bush, and it is possible, or even probable, that more mounds of the same appearance and size lie in these directions. About 1 mile to the south of the Melhado group, on the hills overlooking the river valley, is the prehistoric Maya ceremonial center of Cahal Pech. It seems likely that the Melhado site was a village, hamlet, or residential unit related to this center; and it is probable that other similar residential groups exist for several miles up and down the valley. Studies and surveys elsewhere in the Belize Valley indicate that there is this sort of distribution of small mounds in the vicinities of the larger mound groups or ceremonial centers; however, it should be made clear that the size, spacing, and clustering of such little mounds — with respect to each other, the natural terrain, or to ceremonial centers — is only very imperfectly known.

None of the Melhado mounds is large. The average size is about 9 by 6 m. in extent and between 30 and 100 cm. in height. They are oblong or oval in outline and sod covered. One mound in the group is of imposing size relative to the others. This one, Mound 1, is 25 by 20 m. at the base, steep sided, and 4.5 m. high. It appears to be a small pyramid type platform. Another mound, 7, is a low platform on which 3 others are placed plazuela-fashion; however, the whole of Mound 7 is no more than 25 by 15 m. across and 1 m. in height.

Excavation of Mound 5 of the Melhado group revealed portions of a low earth and rock platform retained by a crude stone masonry wall. This platform was adjoined by a lower and sloping rock apron on the south, or south-southwest, side and by a reinforcing rock fill on the east side. A great many potsherds and several stone artifacts were found on and in the fill of the platform and among the rocks. These materials were encountered down to the original clay ground surface. Among the artifacts were chipped stone scrapers, a lance or blade fragment, an ax fragment, and a metate and mano. The utilitarian nature of these implements and the size and form of the little platform strongly suggest that Mound 5 was, indeed, a "house mound" or artificial platform for a small domestic building. Such a building or successive series of buildings, were, undoubtedly, made of perishable materials. Two fired clay briquettes from the rubbish support such a contention.

A profile trimming operation in an old excavation of Mound 1 showed that structure to have been built of earth and rock fill capped and retained by stone masonry. Two principal constructional levels were visible in this profile. The stone masonry, as revealed in Mound 1, was of a more substantial and more carefully made sort than that in Mound 5.

The ceramics from Mound 5 are largely those which correspond to the Tepeu or Late Classic period of Maya prehistory. This cross-checks with the Periods IIIa, IIIb, and IV at the site of Benque Viejo. The majority of the identifiable sherds fit most closely into the Benque Viejo IIIb-IV periods. From this it seems most probable that the construction of the Mound 5 house platform was an event of the IIIb, or Tepeu 2 period, and that occupation lasted well into the IV, or Tepeu 3 period. A few earlier sherds, both of the Early Classic (Tzakol, Benque Viejo II) and Formative (Chicanel and Mamom, Benque Viejo Ib and Ia) periods were also found in the Mound 5 digging. These indicate an early occupation of the Melhado site, as a whole, but it is unlikely that they date Mound 5. Pottery from Mound 1 is largely of the Chicanel period. Chicanel sherds date the premound ground surface, and are also found in mound fill; however, a few Early Classic and Late Classic fragments come from the mound fill, and it is quite possible that Mound 1 was not completed until Late Classic times.

The Melhado site was, then, occupied from the Formative period — perhaps from the Early Formative — up through the Maya Classic periods. Assuming the Mamom phase of the Formative to date from the second millennium B.C. and the final phase of Tepeu to close at approximately A.D. 900, this occupation spanned some 2000 years. We cannot date the present form of the site from the evidence that is available, but Mound 5 appears to have been constructed in Late Classic times, and Mound 1 may not have been finished until then. It is possible that mounds in the group belong to these final phases of the Classic Maya although the presence of earlier ceramic materials makes this doubtful.

The significance and function of the site can only be speculated upon. The small cluster of little mounds (presumably of a domestic nature) grouped around the single pyramid mound suggests a village or hamlet unit in which certain religious and/or political functions were maintained on this local level. As mentioned, it also seems reasonable to believe that this hamlet was in some way related to, possibly tributary to, the nearby and contemporary ceremonial center of Cahal Pech.

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THE ARCHAEOLOGY OF JAMAICA: A PRELIMINARY SURVEY

ROBERT R. HOWARD

JAMAICA, the third largest island in the West Indies, has probably received less archaeological attention than any other island in the Greater Antilles. There are several reasons for this neglect. Jamaican archaeological remains are not very spectacular and offer few features to excite the interest or curiosity of the casual observer. The Jamaican Arawak were exterminated so early and so effectively by the Spaniards that they were able to contribute virtually nothing ethnically or culturally to the history of the island in the historic period. Perhaps because of these factors, there has never been any strongly established tradition of amateur archaeological activity in Jamaica such as has flourished for many years in Cuba or Puerto Rico, for example. Moreover, until very recently, few institutions outside of the island have taken any sustained interest in Jamaican archaeology and governmental funds and facilities for scientific investigations of all kinds have always been grossly inadequate.

There are a few casual references to archaeological discoveries in the early writings of such authors as Long (1774) but most of the finds thus described have long since disappeared. Those that have been preserved usually have little or no supplementary information accompanying them regarding circumstances of discovery or context.

Archaeological research, in the fullest sense of the term, was not initiated in Jamaica until the last decade of the 19th century. The two most important pioneers in this field were J. E. Duerden and Frank Cundall, both of the staff of the Institute of Jamaica in Kingston. Neither was a professional archaeologist but both were scholars of catholic interests and accomplishments. Duerden's monograph on aboriginal Arawak remains (1897) was inspired by the enthusiasm of Lady Edith Blake, wife of the then Governor General, who had assembled an excellent collection of pre-Columbian materials (Blake 1895) which was later purchased by the Museum of the American Indian, Heye Foundation, in New York. Lady Blake, Cundall, Duerden, and a few other amateurs had sponsored an archaeological exhibition at the Institute in 1895 and it was from this that the Duerden report stemmed. For its day, this compilation is an exceptional piece of work and remains the best published summary to date on Jamaican archaeology. Cundall (1894) in his research on the life of Columbus and the discovery of Jamaica was the first to realize the value of early Spanish historical accounts in reconstructing Arawak culture from the archaeological remains.

Unfortunately, the efforts of these early workers did not succeed in arousing active and continued interest and relatively little was added to the basic knowledge about the island's prehistory until the last decade. During the next 30 years there were only sporadic surveys and collections made by various individuals and expeditions. R. C. MacCormack (1898) undertook several excavations in middens and caves in southern Vere and the Portland Ridge region of Clarendon in 1895. The materials he recovered formed the nucleus of the present Jamaican collections in the U. S. National Museum. Additions were made to these by J. Brennan around 1900 and Gerrit S. Miller (1932) in 1931. Herbert Krieger also made collections and excavated briefly at several sites near Kingston but these have never been fully described in the literature. Reichard and Bastian (Reichard 1904) were the only European archaeologists of note ever to visit Jamaica. In 1904 they made surface collections and explored several burial caves near Montego Bay, the materials from which now repose in the Museum für Völkerkunde in Berlin. The collection of some 1500 artifacts from Jamaica now in the American Museum of Natural History was a gift from G. C. Longley (1914), a New York amateur, who had wintered on the island for 6 years. Longley dug in a number of refuse heaps near St. Ann's Bay and bought many specimens to add to his own finds. He presented the total collection to the American Museum in 1914.

The only major detailed excavation between 1900 and the present period was the work of Theodoor de Booy who, in 1913, did extensive digging at the Retreat property in St. Ann. His report was first published in the *American Anthropologist* (de Booy 1913) and later reprinted by the Museum of the American Indian, Heye Foundation, where his materials were eventually deposited.

In 1933, Marian DeWolf and her husband made test excavations at 3 sites in St. Ann parish and presented their finds and field notes to the Museum of the American Indian. Her report of the excavations (DeWolf 1953) is especially important for the description of a new pottery type unknown from other Jamaican collections.

The revival of interest in Jamaica's prehistory in the last 10 years has been due in no small degree to the activities of C. B. Lewis, Curator of the Science Museum of the Institute of Jamaica. In addition to offering facilities and expert advice to visiting scholars, Lewis has made a number of important archaeological investigations himself, most interesting of which is an aboriginal burial cave near Cambridge Hill, St. Thomas. At least 3 collectors of archaeological materials are active on the island at the present time. These are Cyril Huckerby of Spanishtown, Harry Vendryes of Kingston, and C. S. Cotter of Golden Spring. Cotter, in particular, has done extensive and important work in the excavation of middens and burial caves throughout the island and has assembled an excellent representative collection of aboriginal artifacts. Cotter (1954) has been especially interested in the remains of the earliest Spanish settlements at Seville and other North Coast sites. The field of early historic archaeology will probably receive further investigation in the near future by parties from the University of Florida and the Institute of Jamaica.

During the summers of 1947 and 1948, the author carried out a preliminary survey of the archaeology of Jamaica under the auspices of the Caribbean Program of Yale University.* A period totaling a little over 4 months was devoted to an inspection of various sites and local collections throughout the island. A number of small scale exploratory excavations were also made. Various museum collections of Jamaican materials in the United States were later studied and the existing literature surveyed. The present paper is largely based on the results of this study.

For descriptive purposes, the archaeological sites of Jamaica may be divided into 3 main categories: (1) midden deposits or village sites, (2) caves, and (3) rock carvings or petroglyphs. At the present count, there are at least 75 midden sites definitely reported from various parts of the island, 27 caves in which aboriginal remains have been found and 9 localities where rock carvings occur. It should be emphasized that the sites enumerated are probably only a small fraction of those actually in existence either at present or in the recent past. The entire coast of Jamaica would appear to be rich in archaeological remains, a large number of which simply have never been reported. In this respect, Jamaica offers an especially fertile field for investigation. Some of the sites described by Duerden, Cundall, and other early investigators are no longer intact or have been largely or completely destroyed.

Midden Sites. In examining the distribution of known sites and in an inspection of the localities themselves, several significant features at once become apparent. First, with the exception of one unusual locality, it is noteworthy that no village or midden site thus far reported is more than 12 miles from the coast and that the great majority are within a range of 1 to 5 miles inland. This would seem to indicate that the bulk of Indian population was clustered along the coastal strip and that the more rugged mountainous interior of the island was largely uninhabited, at least as regards permanent village sites. The chief area of inland occupation appears to have been south of Rio Bueno, Dry Harbor, and St. Ann's Bay. This region is one of the few in the interior of Jamaica which would have been both easy of access and suitable for manioc agriculture. It is quite possible, of course, that the concentration of sites in this region, as plotted on a map, gives a false picture of prehistoric population distribution. Practically all the archaeological activity on the north coast, particularly by non-

* The author wishes to express his gratitude to the staff of the Institute of Jamaica in Kingston who provided every courtesy and research facility. Particular thanks must go to Eric Deuchars, Secretary of the Institute, who greatly aided in the photographing of various specimens, and to C. Bernard Lewis, Curator of the Science Museum, without whose knowledge, enthusiasm, and help the work could never have been accomplished. Illustrations of specimens in the Institute collections are reproduced herewith by permission of the Board of Governors. C. S. Cotter of Golden Spring offered invaluable assistance and information at every point. In the United States, we are especially indebted to Irving Rouse of the Department of Anthropology of Yale University who provided insight, encouragement, and constructive criticism in every phase of the undertaking. Finally, our thanks go to Shirley Glaser, staff artist of the Peabody Museum at Yale, who prepared the drawings for the plates which accompany the article.

professionals, has been confined to this general area. Perhaps equally intensive investigation of other sections of the island would yield comparable results.

One possible explanation for this group of sites is that they represent a late period withdrawal of coastal populations similar to that which occurred elsewhere in the West Indies (Rouse 1952: 568-70). This movement may have been due to the pressure of increasing population or it may represent a retreat in the face of hostile attacks on coastal settlements by the expanding Taino groups and, just prior to European contact, the warlike Carib.

It is of interest that village sites throughout Jamaica are, almost without exception, on or near the tops of low lying hills, bordering the coastal plain, which afford a clear view of both sea and shoreline and at the same time offer positions easily defensible from attack. The majority of midden sites are also located fairly close to a source of fresh water supply and near land suitable for agriculture. The Jamaican Indians undoubtedly belonged to the Sub-Taino branch of the Arawak stock and this pattern of occupation is apparently typical of Sub-Taino culture wherever found, as Rouse (1942: 145) has noted a similar location preference in the Baní sites of Cuba. Most of the middens are relatively shallow and give the impression of having been occupied only a short period of time. A few exceptional deposits run as deep as 2 or 3 m. in some spots. The vast majority of sites, however, are only a few centimeters to 1 m. in depth. Such shallow middens may often be spread over a considerable area. Most of the sites investigated by the author, though, covered less than 1 acre. Apparently, the pattern in Jamaica was one of brief occupation by a group over a fairly wide area or movement from midden to midden by smaller groups. There seems to be no sharp differentiation between coastal and inland sites except for the slightly greater proportion of sea shells over land forms in the former. As in Cuba (Rouse 1942: 135), sites closest to the sea are generally somewhat shallower than those in the interior.

There is no apparent formal arrangement of dwellings or other structures in any of the midden sites, although careful excavation might reveal otherwise in some cases. Stratification is only rarely present and, thus far at least, there is no evidence of culture change or differentiation where it does occur. Most of the middens are composed of sherds, griddle fragments, coney bones, fish spines, turtle and bird bones, pieces of coral, bits of limestone and other minerals, occasional stone artifacts such as celts and beads, ash and charcoal, and large quantities of land and sea shells with giant conches usually predominating. Authentic burials almost never appear in middens although a few human bone fragments sometimes come to light. Most of the "Arawak" burials reported from middens in earlier writings probably represent slave interments. It is obvious from the remains of these refuse deposits that the chief staple of Indian diet in Jamaica was shellfish. Manioc agriculture was probably of almost equal importance as the numerous griddle fragments point to the manufacture of cassava bread. Considering the popularity of shellfish, the concentration of village sites near the coasts is hardly surprising.

The preference for hill tops can be explained in several ways. Defense may have been the primary consideration but there is no evidence of earthworks or palisades. Undoubtedly, a certain amount of intertribal warfare was carried on by the Arawak in Jamaica and the encroaching Taino had to be fended off, but the picture of these people as it emerges from the historical accounts is not warlike. Some writers have maintained that it was fear of the Carib raids that forced this occupation of strategic hill top sites but the Carib threat came at much too late a date to have had any great influence in determining such a widespread village location pattern. The simplest explanation is that the hill tops, exposed to sea breezes, were, then as now, the most healthful and pleasant places to live in tropical Jamaica.

The gap in site distribution from Port Antonio on the north coast to Morant Point at the eastern tip of the island is probably more apparent than real. Sven Lovén (1935: 119) has advanced the theory that the lack of sites here is attributable to less abundant sea life along the northern and eastern shores due to prevailing winds and ocean currents. C. Bernard Lewis and other Jamaican naturalists, however, do not concur with this suggestion. While shellfish collecting and fishing may have been more difficult along these rocky shores, it seems more likely that the paucity of reported sites in this area is due to the heavy cover of dense vegetation which effectively obscures whatever remains may be present. There is

certainly no indication in the accounts of Mendez and Columbus (Cundall 1894) that this portion of Jamaica was uninhabited at the time of first European contact.

There are no plazas, ball courts, megaliths, or any other ceremonial structures yet reported from Jamaica. This is to be expected as Sub-Taino sites elsewhere in the Indies tend to lack any such manifestations of ceremonial elaboration.

Caves. The Tertiary limestone that covers so much of the surface of Jamaica has been eroded and decomposed to form innumerable caves, sinkholes, and underground passages. Most of the caves are relatively small and the floors are usually covered with an accumulation of bat guano, fallen rock, and other debris that makes investigation both difficult and unpleasant. The caves containing aboriginal remains, which have been discovered in Jamaica up to the present, seem to have been used in 3 different ways: (1) dwelling sites, (2) ossuaries, and (3) ceremonial chambers. The latter use can be inferred only from the fact that 3 large wooden zemi images, now in the British Museum, were originally found in a cave in the Carpenter Hills in the 18th century.

At the time of Duerden's report (1897), there were no cave sites known which gave any indication of having been used for occupation purposes. However, the discovery and exploration of the caves in the Portland Ridge area by C. B. Lewis, the author, and others in recent years has yielded conclusive evidence that caves were occasionally utilized as dwelling places by the Arawak. The Portland Ridge finds, however, would appear to be the exception rather than the rule in Jamaica. For some reason, caves were utilized by the aborigines almost exclusively for burial purposes. The majority of the caves on the island were too limited in size ever to have housed more than a few individuals at one time. Early writers on the subject of caves were fond of the theory that the human remains discovered therein represented the last tragic relics of Arawak who had hidden either from the Carib or the Spaniards and, somehow, had been immured in their place of refuge. This romantic interpretation is still held by some individuals on the island today. However, as Duerden (1897: 25) pointed out long ago, the best known cave of that period, the Halberstadt, could not possibly have held more than 12 living adults while the bones of at least 34 individuals were discovered. Moreover, the proper proportion of bones is barely present. Some long bones and skulls are often missing entirely.

In general, unless the cave gives indication of being undisturbed, it is very difficult to determine accurately the original disposition of the bones and whatever other remains may be present. Displacement, due to earthquakes, fallen rock, and vandalism, is all too evident in most of the known caves. Skulls, particularly, are in demand by present day "obeah" practitioners although, as a rule, most natives shun and fear burial caves. No consistent pattern of deposit is apparent for the skeletal material in caves. Most of the bones do not seem to have been covered originally by earth or stones. In one or 2 caves, skulls have been found placed in rough alignment, sometimes occupying natural shelves or ledges, but the usual arrangement is one of indiscriminate scattering of the bones on cave floors. The evidence is fairly clear that all the cave burials encountered thus far are secondary in nature. The bones give no indication of attempted cremation. Skulls and, sometimes, long bones were often placed in large pottery vessels and most of the complete pots found in museum collections today were obtained from burial caves. At one time, an excellent collection of skeletal material from these caves was available for study in the Institute of Jamaica but recent word is that it was largely destroyed by the violent hurricane which damaged the buildings of the Institute severely a few years ago.

Aside from pottery, only a few other objects of archaeological interest have been found in caves. These include a lignum vitae Arawak seat, some large bark slabs which may have been either shields or pieces of a canoe, wooden "canoe" fragments of doubtful authenticity, shell beads, and the usual assortment of conchs, fish spines, and coney bones. In general, the distribution of burial caves corresponds fairly closely to that of the midden sites around the island.

Rock Carvings. Nine rock carving sites have been reported, at one time or another, from various parts of Jamaica but it is difficult to determine how many of them are still in existence today. Indications as to their location are somewhat vague in the earlier reports and, for some obscure reason, vandals have effaced or chipped off and carried away most of the

known carvings shortly after their discovery. The only reproductions of Jamaican rock carvings in the literature are a few line drawings and several inadequate photographs contained in the Duerden monograph (1897: 48-51). One carving of a human face, which appears to have been chipped out of its context, is in the Institute of Jamaica collection but its authenticity is doubtful.

Judging from all the available evidence, the carvings are true petroglyphs rather than pictographs. That is they are made by the use of incised lines cut in the stone and are not simple paintings on the rock surface. While pigments may have been used in conjunction with incision, exposure and erosion have effectively destroyed all such evidence except in the case of one known example at the site of Mountain River.

Human and animal representations are the chief motifs in Jamaican rock carvings with the former predominating. Undoubtedly, the carvings had some sort of religious significance but it is futile to speculate any further about their meaning. Most of the carvings are simple in the extreme. Facial and body features are delineated by means of lines and dots and further details are left to the imagination. The most extensive rock carving site was found by Duerden (1897: 50) at Mountain River in St. Catharine Parish. In addition to several human representations, between 100 and 200 figures depicting various forms of animal life were also discovered including lizards, birds, and turtles. An unspecified black pigment, which had apparently withstood weathering very satisfactorily, had been used in connection with their execution.

Petroglyphs often provide clues as to the presence of archaeological sites in their vicinity and future Jamaican archaeologists might find exploration of areas where such carvings occur rewarding. It is interesting, however, that excluding 3 carvings in the Canoe Valley Road region, most of the reported rock carving sites are considerably farther from the coast than are the midden and cave sites and seem to bear no relation to them in regard to distribution. What significance this may have can only be determined by further investigation.

POTTERY: MAJOR STYLE

At the present stage of archaeological knowledge and research in Jamaica, it is obviously impossible to make a complete or exhaustive study of the aboriginal pottery. This becomes particularly evident if one attempts to evolve developmental sequences or cultural differentiation in time and space on the basis of pottery analysis. The great bulk of Jamaican pottery collections in museums was made without any of the problems of modern archaeological research in mind. Furthermore, such information as did exist in the form of labels and supplementary field notes has, in large part, been destroyed or lost through the years. Until careful, large scale stratigraphic excavations are made and the undoubted regional and temporal differences in pottery traditions can be established accurately, it seems best to treat most of Jamaican pottery in terms of one major stylistic unit. Actually, from the evidence accumulated thus far, the pottery is remarkably homogenous, both in techniques of manufacture and range of decorative modes employed. Only 2 variant substyles, Little River and Montego Bay, can be isolated at present. These will be discussed below.

In terms of the ceramic classification for the West Indies proposed by Rouse (1939: 39), the bulk of Jamaican pottery belongs to the Meillac group, although it is distinctive and unusual in several respects. Its closest affiliations are with the Sub-Taino wares of Cuba, particularly the Baní. In time, the author feels it will be possible to establish a completely formulated pottery style in Jamaica comparable to Meillac in Haiti and Baní in Cuba but such an attempt seems premature in the present state of knowledge.

Shape. As a result of numerous finds in burial caves, an unusually large number of complete or nearly complete pottery vessels are available for study. There are 2 basic shape categories for Jamaican pottery: (1) round bowls, and (2) boat-shaped vessels. Minor variants occur in each of these divisions.

The boat-shaped vessels (Fig. 2 *d*) are oval in outline, viewed from above, and terminate at either end with elevated handles that are cylindrical or flat with flaring tips. These are often further decorated. A variant of this type of boat-shaped vessel occurs when only one end is elevated and a calabash shape is produced. Sometimes, terminal handles are absent and the "prow" of the vessel is merely brought to a slightly thickened triangular peak. The lower part of both round and boat-shaped bowls is almost invariably symmetrically rounded. The one flat-bottomed vessel known to the author is a case of somewhat doubtful restoration. One conoidal-bottomed cup is present in the Institute of Jamaica collection.

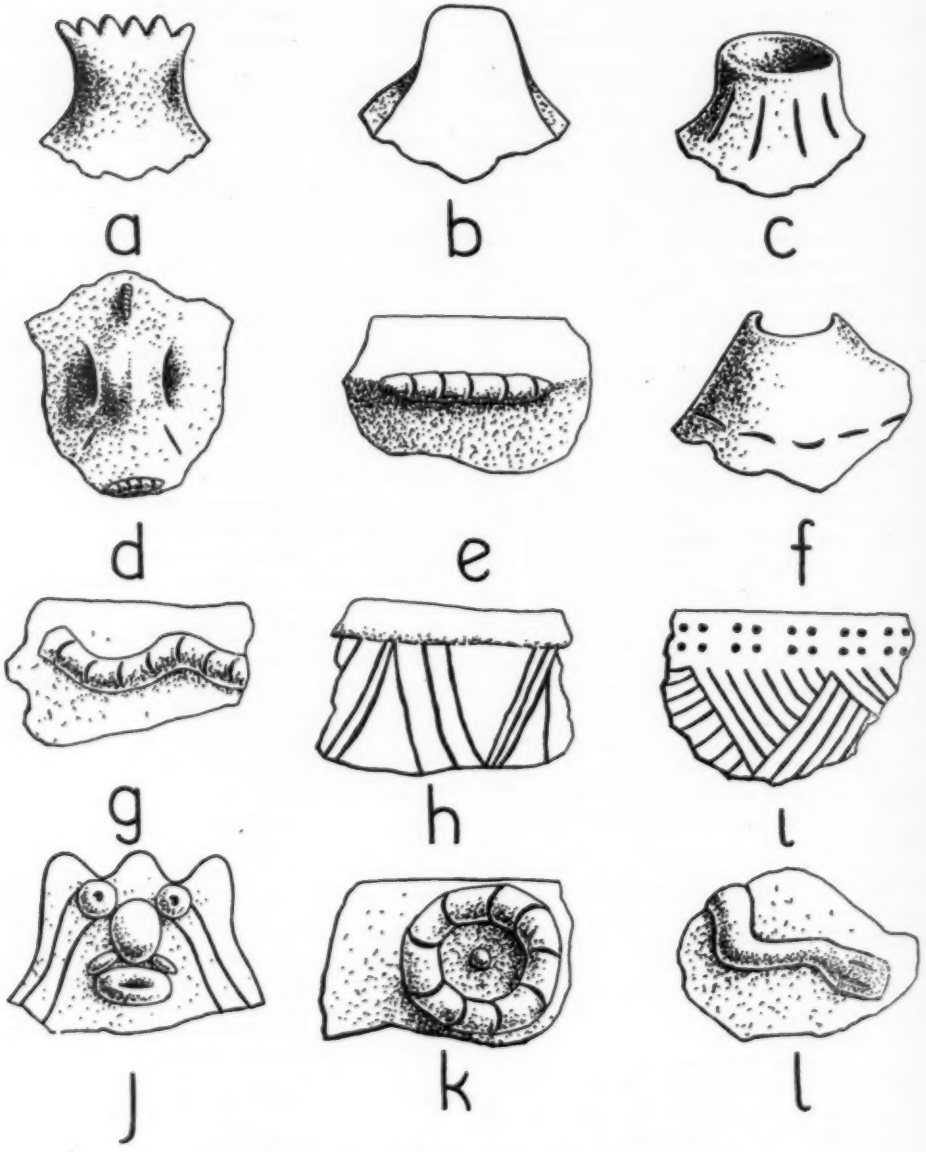

FIG. 1. Handles, lugs, and decorative modes on Jamaican pottery.

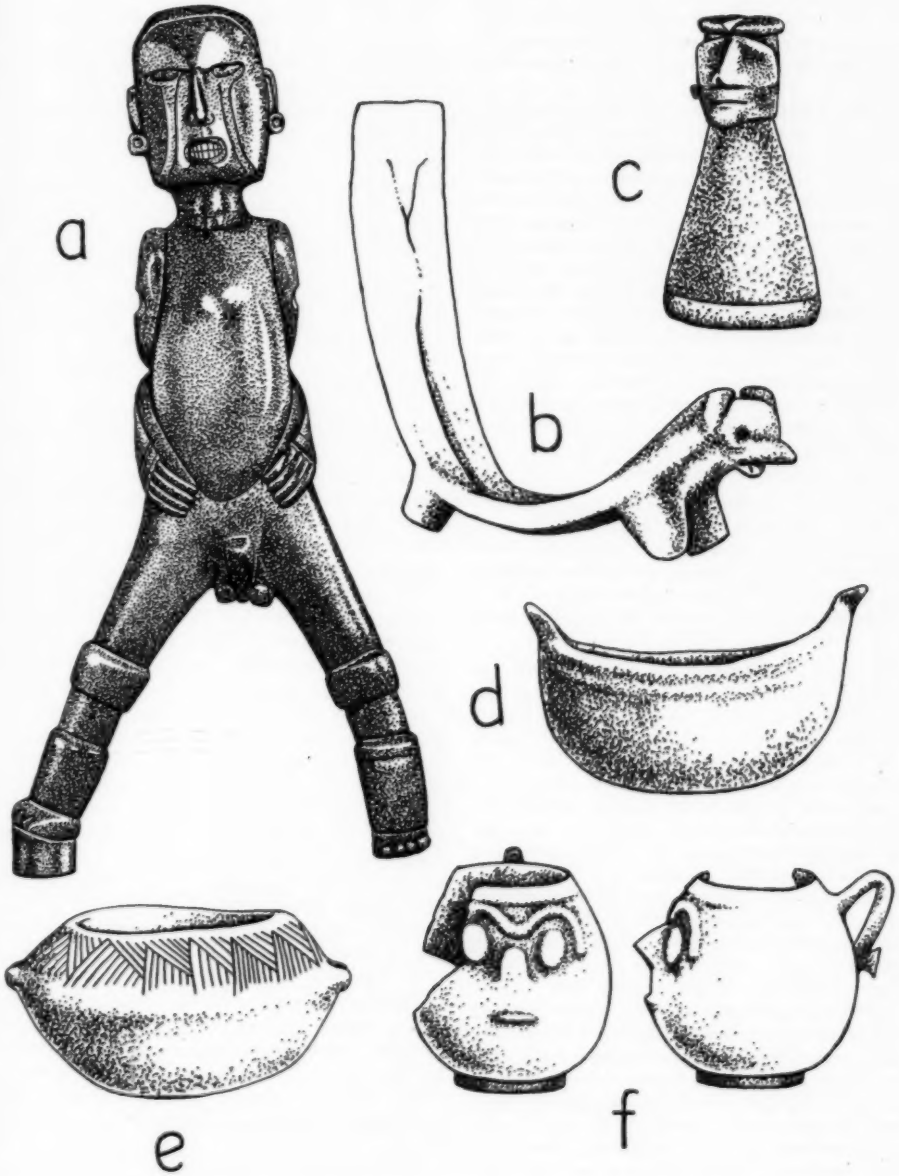

FIG. 2. Jamaican wood and stone artifacts and complete pottery specimens.

The majority of both round and boat-shaped pots are shouldered. In most examples, the shoulder is slightly convex. As a rule, the sharper the angle of shoulder inturn, the flatter the shoulder will be. Shoulder width is uniform on the round bowls and becomes either slightly wider or narrower at the ends of boat-shaped vessels.

Virtually all of the round bowls are symmetrically shaped with incurved sides, resulting in an aperture smaller than the greatest diameter of the vessel (Fig. 2 *e*). Some round bowls are fairly deep and full bodied, others are broad and shallow. In a few rare cases, the vessel approximates the shape of a hemisphere. Only occasionally, is any portion of the rim raised above the rest of the vessel. Round bowls vary from 17 to 20 cm. in width and from 8 to 15 cm. in height. The largest boat-shaped vessel encountered by the author measured 40 cm. in length, 28 cm. in height, and 25 cm. in width.

Several shapes, such as tripod based, annular based, and compartmented vessels noted by Rouse (1941: 57) for Meillac pottery in Haiti have not as yet been discovered in Jamaica. The only specimen of a miniature or paint pot is that reported by DeWolf (1953: 232) as having been found at Little River.

Apertures. In all the complete specimens apertures are large, in most cases being at least ⅔ of the maximum width of the vessel and, in the case of a few boat-shaped vessels, almost the same size. Several rim sherds appear to have come from jars or constricted bottle necks but it is difficult to determine the original size or shape of these containers.

Manufacture. The methods of pottery manufacture suggested by Rouse (1941: 55-8) for Meillac pottery were apparently those employed in Jamaica. Like its Haitian counterpart, Jamaican pottery is of coiled construction, the coils being set and shaped by anvil and paddle technique rather than scraping. The clay of the fired vessels varies in color from brick red through reddish gray, reddish brown, dull black, buff, and pale yellow. The finished pots were fired by the open hearth method and several sherds show what appears to be a layer of black carbon between the outer and inner surfaces which is probably the result of imperfect firing. Most of the body sherds found in middens are blackened through exposure to fire either from cooking soot or due to the firing process itself.

Vessel walls in Jamaican wares tend to be relatively thin and uniform in thickness throughout. The thinnest specimen measured in the collections was 4 mm., the thickest 1 cm. The average thickness seems to be about 8 mm. A dull polish was universally applied to the outer surfaces and often to the interior of the pot as well. Decorated surfaces, lugs, and handles are hardly ever polished, however. None of the specimens examined gave evidence of bearing a true slip.

There is little indication of added coloring matter or artificial temper in Jamaican pottery. Apparently, the available clays contained the necessary ingredients for successful pottery manufacture in their natural state.

Rims. Rim profiles, viewed in cross section, are of 3 types: (1) rounded, (2) tapering, and (3) rectangular. Rounded rims are the most common variety. Tapered rims usually show tapering on the inside only. Ridges or fillets were frequently applied along the outer surface of the rim. Thickening of the rim coil often produces much the same effect. In at least one example, a ridge has been placed on the inside of the rim but this is uncommon.

Decoration. While it is difficult to estimate percentages, it can safely be said that the majority of Jamaican vessels are undecorated or only very sparingly decorated. Other writers, such as Rouse (1939: 117) and Rainey (1940: 148), who have made comparative studies of West Indian pottery agree that there is less decoration, and that fewer decorative modes appear on Jamaican ceramics than on comparable wares elsewhere in the Caribbean. On the other hand, several decorative techniques noted below seem to be confined almost exclusively to Jamaica.

With the exception of the aberrant Montego Bay subtype, the use of incision in Jamaican pottery is relatively rare. Incised designs were usually executed with a thin, sharp implement, perhaps a bird or fish bone, and no attempt was made to smooth or polish the area afterwards. Shoulders, handles, and lugs are the favorite areas for incised decoration. Rims and ridges only occasionally receive such treatment. The designs are invariably geometric and are simple and limited in number for the most part. The most common design is composed of groups of alternating oblique parallel lines producing a W-shaped effect (Fig. 2 *e*). When applied to the shoulder this design runs uniformly around the vessel. There are several variations to this basic pattern. Oblique parallel lines, sometimes slightly curved, and vertical parallel lines are also used. The latter, however, are usually confined to lugs and handles. A pair of horizontal parallel lines are often incised around the vessel just below the rim or on the ridge. Sometimes a third line is added but rarely, if ever, more.

Crosshatching, so common in Meillac wares elsewhere, is surprisingly rare in Jamaica. The same is true of the X design. One handle from the Longley collection in the American Museum bears a deeply incised V but this is the only example known to the author.

The favorite decoration for rim tops is that of closely spaced parallel incisions, usually about 5 mm. apart, which are sometimes cut deeply enough to give the edge a serrated effect. Curved lines occur on only a very few sherds. Spirals, concentric circles, and parallel curved lines comprise the uses to which curved incision is most frequently put.

Punctation is only infrequently employed as a decorative mode in Jamaican Meillac. It usually accompanies line incision. Most commonly, evenly spaced parallel rows of dots are placed on the shoulder or on the rim and above any incised design that may be present (Fig. 1 *i*). Most dots are small but one or two measure as

much as 1 cm. in diameter. Their shape depends on the implement that was originally used to make them, bird and coney bones or slivers of hard wood probably being the tools most often employed.

The technique of application, of the sort so frequently encountered in Meillac decoration in the early period in Haiti, in which strips of clay are applied to the surface of the vessel to form geometric and naturalistic designs, is only rarely encountered in Jamaica. Several different applied designs have been noted thus far. These include a sigmoid or S-shaped motif (Fig. 1 *g*), a dot and circle design with a dot of clay placed inside a circle (Fig. 1 *k*), an applied spiral, and a limb design in which an applied strip has been flattened and broadened at one end and marked with two vertically incised lines so as to vaguely resemble the limb of an animal or reptile (Fig. 1 *l*). These designs were most often applied to the vessel shoulder. One unusual handle (Fig. 1 *j*) has human facial features depicted by means of application but it is unique in Jamaican collections.

Lugs and handles show the greatest variation and are the most consistently decorated features of Jamaican pottery. There are 4 main types of handles: (1) the cylindrical knoblike handle, (2) the loop handle, (3) the flaring tipped handle, and (4) the raised laterally perforated knob handle.

The loop handle (Fig. 1 *b*) is the least frequently encountered of these. It was made by affixing a thin, rectangular, ribbon-like strip of clay in the shape of a loop with one end attached to the vessel shoulder and the other to the rim. Such handles never seem to show further decoration. The flaring tipped handle (Fig. 1 *a*) is the type most often met with. These handles are usually placed at either end of boat-shaped vessels in such a way as to be continuations of the vessel wall. Sometimes, this handle remains relatively thick and flat; at other times the entire handle is thickened and becomes somewhat oval in cross section as a result of the pinching in process. The tip surface is usually serrated more or less heavily in such cases. Cylindrical knobs (Fig. 1 *c*) are frequently placed at either end of vessels at the apex or just below the rim. There may be only one knob or groups of two or three. The tops of these knobs are ordinarily slightly depressed.

The fourth main type of handle (Fig. 1 *d*) seems to be a development unique to Jamaica. Rouse (personal communication) reports occasional finds of such handles elsewhere in the West Indies but believes they are trade sherds from Jamaica. This rather massive handle is composed of a raised knob that has been perforated laterally. A small serrated ridge is usually applied to the vessel wall under the handle so that the total effect is one of a crude face with the perforations representing the eyes, and the ridge, the mouth. It would be interesting to know to what type of vessel these handles were affixed. Judging from their size, they were probably used on large bowls or water jars.

There are a few other aberrant handle types but these occur so infrequently as to suggest they may be trade sherds. Decorative modes on handles comprise most of those already discussed.

Lugs are of 2 chief types, the most important being the wedge-shaped variety which is usually applied to the vessel at the inturn parallel to the rim (Fig. 1 *e*). These lugs may be placed in opposing pairs at either end of the pot or, in the case of circular bowls, another set of pairs may be added on opposite sides of the vessel. These wedge-shaped lugs are almost invariably vertically incised and, sometimes, horizontally as well. Such lugs are frequently placed on the shoulder or rim at the ends of the vessel and may be combined to form different decorative patterns. The other type of lug is a cylindrical knob, similar to the cylindrical-knobbed handle, except that it is smaller and has been moved down to the vessel inturn. This type of lug is often placed in pairs at opposite ends of the pot.

Perforation of the shoulder at the base of the handles is sometimes practiced on Jamaican pottery but it does not occur frequently. Usually the perforations are paired, with one hole on either side of the handle base to allow the vessel to be suspended.

Painting. Aside from the distinctive Little River pottery discovered by DeWolf (1953), painting is conspicuous by its absence or near absence as a decorative mode in Jamaican ceramics. Five sherds from Jamaican collections bearing traces of paint are known to the author, Little River material excluded. These sherds come from widely scattered localities on the island. All are small and bear only a few flecks of dull red paint. In view of the extreme rarity of painted wares, and the distribution of the sherds that have been found, it is most likely that the examples mentioned are all trade sherds.

Modeling. Modeling was relatively poorly developed in Jamaican pottery. A few handles and lugs show modeled heads that may be either human or animal representations. Several can be identified, with fair certainty, as turtle or snake heads. These specimens are sometimes hollow, sometimes solid. The mouth and eyes are indicated by crude incision.

Molding occurs on several sherds in Jamaican collections that resemble closely the Red Ware reported by Krieger (1931: 76-7) from San Juan in the Dominican Republic and a similar pottery type discovered by Fewkes (1907: 180-1) near Manati, Puerto Rico. As the Red Ware occurs at fairly early levels in these sites, its appearance in Jamaica may eventually offer some clues in dating sites where it is found. The author collected examples of the ware in such widely separated sites in Jamaica as Montego Bay and Portland Ridge but only in very small numbers. These sherds consist of raised pottery surfaces representing the features of the human face and constitute an extension of the vessel body itself rather than being affixed or luted. The distinctive color of the ware was achieved by the application of a red slip. The sherds are usually highly polished.

Probably these are trade wares but another interesting possibility is that they may be part of the Little River substyle. Only more intensive investigation of Jamaican ceramics will provide the final answer.

A unique pot from the Henry Vendryes collection (Fig. 2 *d*), which was recovered from the White Marl site near Kingston, combines so many features rarely or never occurring in Jamaican wares that it is almost certainly a trade piece, possibly from Puerto Rico or the Dominican Republic. These modes include globular shape, face modeling on the vessel front, "coffee bean" eyes, ring base, U-shaped handle, and the use of "tear lines" beneath the eyes.

Other Pottery Manufactures. Pottery pestles are occasionally encountered in Jamaican collections. They are roughly conical in shape, elongated, and cylindrical in cross section. Several of the specimens are laterally perforated at the top and at least one shows a concave depression on the bottom. This may indicate that these implements were amulets or ornaments of some sort rather than pestles.

Griddle fragments are among the most frequent finds in Jamaican midden sites. No complete examples have ever been found but, judging from the pieces, the original specimens averaged between 30 and 35 cm. in diameter. They were approximately circular in shape, slightly polished on the upper surface, and often beveled around the edge. The average thickness of these griddles is between 2 and 3 cm. Most of them were poorly fired as the clay in the center of the griddle often disintegrates when exposed to water.

Pottery: Variant Substyles

Little River. The Little River substyle was discovered by DeWolf on the north central coast of Jamaica in 1933 and was discussed in print (DeWolf 1953) some 20 years later. In terms of the time scale set up by Rouse (1939, 1941, 1948, 1951, 1952) for the West Indies, Little River is probably the earliest ceramic tradition to appear in Jamaica. There is no evidence, as yet, of any preceramic culture corresponding to Period I Ciboney or similar cultures elsewhere in the Indies. Nor does the Cuevas horizon style typical of Period II seem to have reached Jamaica. The Little River style, as DeWolf points out, probably belongs to Period IIIa and represents an extension of the Cuevas-Ostiones tradition of Puerto Rico into Jamaica. DeWolf feels it to be closer to early Ostiones than to either Cuevas or late Ostiones style. Certainly the high incidence of D-shaped handles, loop handles, flat bottoms, use of paint, and the rarity of incised and affixed decoration in Little River wares mark them off distinctly from the main body of Jamaican pottery.

Montego Bay. While less striking in its deviation from the main Jamaican pottery tradition, the distinctive ware found by the author at the Fairfield site, near Montego Bay, is so unusual in several respects, particularly in its use of incision, that is seems probable it represents a definite substyle. The sherds from the Windsor site reported by DeWolf (1953: 236) undoubtedly should be classified with this group. The favorite design employed in the Montego Bay ware consists of groups of short, horizontal, parallel lines heavily incised around the vessel just below the rim about one centimeter apart (Fig. 1 *h*). The groups usually contain either 3 or 4 lines. Sometimes, a single broken line is incised around the rim edge. In all cases, the incision tends to be exceptionally broad and deep. Short, wide, oblique parallel lines form another common design, usually placed on rim edges. The massiveness of Montego Bay ware allows sufficient space on the rim surfaces to permit decoration. The most popular design for this purpose consists of 2 rows of alternating short lines that are little more than elongated dots. Virtually all the incision on Montego Bay ware is much deeper, heavier, and less carefully applied than that usually found on Jamaican pottery. Little or no smoothing apparently was done after the incision had been made. This type of incision seems in keeping with the coarse heavy nature of the ware itself.

Precisely what relation Montego Bay bears to the main tradition of Jamaican Meillac or what its position in the time sequence may be cannot be fully determined without careful stratigraphic excavation. The author is inclined to place it at a somewhat late period, perhaps early in Period IV, though it certainly bears no relation to Carrier or other typical Period IV wares elsewhere in the Indies.

Pottery: Summary

Viewing Jamaican pottery as a whole, the 2 substyles excepted, one receives the impression of a relatively undifferentiated and conservative tradition, conforming in general to the Meillac pattern as it developed in the West Indian culture center to the north and east. An analysis of the characteristics of classic Meillac as formulated by Rouse (1940: 57-8) indicates immediately the predominance in Jamaican pottery of modes typical of the later forms in the main Meillac tradition. For example, cylindrical lugs, zoomorphic face design, horizontal parallel line design, limb design, and sigmoid design are all listed by Rouse as absent in early Meillac wares but all are present in Jamaica. On the other hand, the grid design, the execution of typically incised designs in application, designs partly incised, partly applied, the dot design applied, and the strip on the rim edge replacing the ridge, all of which are absent in late Meillac, are conspicuous by their rarity or absence in Jamaica. Painting, of course, occurs only in the earliest levels in Haiti. Such painting as occurs in Jamaica seems more closely allied to Puerto Rican traditions and probably derives from this source, directly or indirectly.

As noted previously, Jamaican wares show a closer resemblance to the Baní type of pottery as reported from Cuba by Harrington (1921) and Rouse (1941) than to the Meillac tradition of Hispaniola. In both Jamaican and Baní pottery, affixation is the technique most commonly used to produce lugs and handles of various designs. The same incised designs are preferred. Loop handles are rare and crudely made and modeling was only poorly developed in the 2 traditions.

Despite these obvious Meillac and Baní affiliations, Jamaican pottery gives evidence of an independent, if rather retarded, development along certain lines. Possibly the peripheral position of the island accounts for this to some extent. Compared with the wares of Puerto Rico and Hispaniola, Jamaican ceramics appear somewhat crude, unimaginative, and provincial. Decorative modes such as painting, modeling, and application occur infrequently and are only rudimentarily developed. Some features of Meillac and Baní, such as ovoid design, line and dot incision, and everted rims, which probably reflect Carrier influence, never diffused to Jamaica.

On the other hand, a few features of Jamaican pottery seem to be confined almost exclusively to the island. most notably the massive, laterally perforated knob handle. The flaring tipped handle is also unusual for the frequency with which it is employed and for the distinctive shape it assumes in Jamaican wares. As the archaeology of Jamaica becomes better known, it will doubtless be possible to distinguish both areal and temporal differences in the pottery of the island to a far greater degree but such analysis must await detailed stratigraphic excavation of a large number of sites.

STONE WORK

Celts. The stone artifacts most frequently encountered in Jamaican archaeological sites are the ubiquitous stone celts. At one time, they were extremely common finds in the countryside but they are much rarer today. The natives usually refer to them as "thunder stones" and believe they are helpful in cooling water if placed in the bottom of a jar.

Jamaican celts are basically so much like those found in other West Indian islands that they need not be described in any great detail. Most of them are petaloid or almond shaped, bilaterally symmetrical, and have been carefully shaped and polished. They vary in size from 5 to 20 cm. in length and average about 4 cm. in width and 2 cm. in thickness. One unusual specimen in the Lady Blake collection is exceptionally large and has a central boss while another is roughly T-shaped. These celts are made from a wide variety of igneous and metamorphic rocks, with basalt, dolorite, and a type of greenish schist being the materials most frequently utilized. The large celts were undoubtedly hafted and the pointed bit was used for chopping and cutting. Rouse (1941: 95) suggests the tiny specimens had ornamental or ceremonial use.

Axes. Only one grooved ax has been reported from Jamaica and it is doubtful whether it is truly Jamaican in origin. The ax is made of diorite and shows some evidence of having been hafted. The entire surface has been smoothed by grinding. The blade is roughly oval in shape with the cutting edge left relatively blunt. Rainey (1940: 148) remarks that this specimen is similar to the eared axes of the Lesser Antilles.

Pestles. Pestles are another class of stone artifact occasionally recovered from Jamaican sites. Five specimens are to be found in the Institute of Jamaica collections and 3 others are present in the Longley collection in the American Museum. All are conical in shape and, with one exception, flat bottomed. The bottom of the variant is slightly convex. Four of the pestles terminate in zoomorphic heads, crudely delineated. One is a fairly well carved representation of a bird. One of the Longley specimens looks as though it may have been a phallic symbol. Two crudely carved heads in the Institute of Jamaica collection are apparently pestle fragments. Like the heads on the complete specimens (Fig. 2 *c*), they are flat-topped with facial features roughly outlined by use of broad incised lines and circular depressions. Pestles are made of sandstone, marble, and basalt. The largest measures approximately 15 cm. in height, the others vary between 10 and 13 cm. It is highly probable, of course, that several if not all of these "pestles" are zemi images or had some other religious significance.

Ornaments. Ornaments of any kind are very rare in either middens or museum collections in Jamaica. Two marble amulets, representing anthropomorphic figures in a flexed position, were found at Long Mountain near Kingston. Both are perforated laterally so that they could be suspended about the neck or, possibly, worn on the forehead when the wearer went into battle. The Arawak of Haiti wore such figurines or amulets in historic times in this way (Lovén 1935: 580). These amulets are 7 cm. in length and 3 cm. wide. Tubular, longitudinally drilled beads of chalcedony, somewhat irregular in size, are to be seen in the Institute of Jamaica collections. These beads average about 2 cm. in diameter and between 1 and 3 cm. in length. A few similar beads were reported found in the Halberstadt burial cave (Duerden 1897: 36). Rainey (1940: 148) indicates that such beads are much smaller than tubular beads usually found in Puerto Rico. Duerden (1897: 36) describes and illustrates a small quartz ornament from the Cranbrook site which has been carved to resemble 2 articulating vertebrae.

Utilitarian Stone Artifacts. Grinding stones and hammerstones have been found at several sites on the island. Most of them are quartzite stream boulders which have been used with relatively little reshaping except for artificial flattening of one surface. A maul or roller of fossil coral, about 30 cm. long and roughly cylindrical in shape, is on display in the Institute of Jamaica.

The only positively authentic flint artifacts thus far found in Jamaica are rough, slightly retouched chips, flakes and cores which were doubtless used as knives and scrapers. The 75 flint arrowheads reported by Lovén (1932) to have been found near Old Harbour are almost certainly not of Jamaican origin. Such arrowheads would be unique not only in Jamaica but the rest of the Greater Antilles as well.

Also of doubtful Jamaican origin are the large 3-legged metates, with accompanying manos which are at present in the Institute of Jamaica collection. They are unmistakeably Central American in design and execution and totally unrelated to the rest of Arawak manufacturers in Jamaica. Probably, they were brought over by groups of Indians from Central America who were sent to Jamaica as auxiliary labor supply by the Spaniards when the native Arawak population was on the point of extinction. The so-called "slave mortars," large flat boulders in which a convex-shaped depression has been made, may possibly be Arawak in origin but none has ever been found in situ in authentic Indian sites.

Several problematical stone objects are to be found in collections of Jamaican materials. These are variously described as pendants, weights, or sinkers. They are carefully shaped, highly polished, spindle-shaped implements which are either laterally perforated at one end or longitudinally pierced. The frequency with which similar artifacts are found in Puerto Rico and other Antillean islands suggests some sort of purely utilitarian function for them.

A stone ball from the Cundall collection (Cundall 1894: 72) and whetstones of chalk and limestone complete the meager inventory of Jamaican stone manufactures.

WOOD WORK

There is good evidence from the historical accounts that the Jamaican Arawak were skilled woodworkers. Columbus, at the time of his discovery of the island, was met by natives sailing large elaborately carved canoes. The fact that stone, shell, and bone work were relatively poorly developed in Jamaica suggests that, in many cases, wood may have taken the place of these materials in the technology. Because of the humid climate, however, very little of the aboriginal woodwork has survived in Jamaica with the exception of objects which were placed in dry burial caves.

The most elaborate examples of woodwork yet found on the island are several large statues which were originally discovered in 1792 in a cave in the Carpenter Hills and later sent to the British Museum. All were carved of mahogany. Of the 4 figures, 2 seem to be zoomorphic representations. The first of these has the head of a long-billed bird with the body carved roughly in the shape of a cross. Bracelets or ligatures are represented around the knees and upper arms. Anatomical details such as thumb and fingers and male genitals are crudely delineated. The other statue shows a bird, also long billed, standing on the back of a turtle, the bird's body being decorated with broad incised geometric designs.

The third statue in the series (Fig. 2*a*) represents a naked male figure, with large square head, standing with legs apart and hands resting on the upper thighs. Eyes and teeth are inlaid with mother of pearl and "tear lines" are carved on the face. Ligatures are shown on the limbs of this statue also. The fourth statue is smaller than the others and represents a crouching human being from whose back and shoulders an umbrella like canopy protrudes. "Tear lines" are also present here. There can be little doubt that these figures are examples of the idols or zemis which played such an important role in Arawak religion and which are so frequently referred to in early literature on the Arawak.

An interesting and important specimen of Jamaican woodwork is the stool or seat found by C. B. Lewis at the Cambridge Hill cave site (Fig. 2*b*). It is the only completely authentic example thus far found on the island of the typical Arawak seat, so commonly associated with Taino culture elsewhere in the Caribbean, and follows the general design of such seats fairly closely. It is made of lignum vitae and is remarkably well preserved. The seat is small, with the bottom resting on the ground, while the front terminates in a carved zoomorphic head. The back of the seat is 9 inches from the ground while the width varies between 3 and 4 inches. A similar wooden stool, lacking the zoomorphic head, in the collection of the Yale Peabody Museum may be of Jamaican origin but this is not certain.

OTHER MATERIALS

Shell. While marine and land shells constitute the great bulk of most of the midden deposits found in Jamaica, shell does not seem to have been widely utilized by the Arawak in the making of tools or ornaments. This is in marked contrast to the Sub-Taino culture of Cuba where shell work was relatively highly developed. Rouse (1948: 516) is probably correct in suggesting that the difference is due to the influence of the Ciboney in Cuba, as the Cibony used shell extensively in their technology.

The marine species of shells found in Jamaican middens are all common in waters around the islands today and include some varieties that are regarded as inedible by present day natives. Practically all the Gastropod species found in sites show a large, irregular, artificial perforation, varying from ½ to 1 inch in size, behind the mouth of the shell. These holes are hardly ever smoothed or retouched in any way. The hole may have been made to facilitate extraction but a more likely explanation is that the holes were employed to string shells together on collecting expeditions. If shells ever were strung into

necklaces there is no positive indication, except in the case of 32 small shell beads made of *Oliva reticularis* which were recovered from a cave at Richmond Hill. Only the body whorl was retained in these beads which are now on exhibition at the Institute of Jamaica.

Shell celts, made from *Strombus gigas*, have been discovered in a few sites. They are generally petaloid, or, more often, oval in shape and approximately the same size as the average stone specimens. None of the shell examples displays the same careful workmanship and finish characteristic of the stone celts. Conch tips, which have sometimes been ground to a fine point, and which were perhaps used as picks or awls; outer portions of the conch broken into the rough shape of a dipper or cup; and curved knife-shaped implements are the only other examples of Jamaican shell work known to the author.

Bone. Considering the poor conditions for preservation, a surprisingly large amount of bone material has been preserved from Jamaican midden sites. The majority of bones found are those of the so-called "Indian" coney, *Geocapromys brownei*, the only mammal large enough to be worth hunting on the island in aboriginal times. While coney bones in their natural state may have been used as tools by the Arawak, no unmistakeable artifacts of coney bone have ever been found in Jamaican middens. The bones of turtles, crocodiles, snakes, birds, and manatees have also been found in a number of sites but, with the exception of a crocodile tooth pendant reported by DeWolf (1953: 236), none of this bone material seems to have been utilized in the technology in any way. Fish bones too, while frequently encountered in middens, give little or no evidence of artificial sharpening or other alteration.

Coral. Pieces of Madrepore coral are frequently met with in midden deposits in Jamaica. Usually, these consist of fragments of coral stems or branches but, occasionally, large, relatively flat slabs are also encountered. The occurrence of such large amounts of coral in midden refuse is somewhat difficult to explain. Some of the pieces may have been used as files, rasps, or graters, but none of the specimens examined by the author gave any positive evidence of having been so employed. Where fossil coral was used, it seems to have been treated merely as another type of stone.

Conclusions. Prehistoric Jamaica does not appear to have been occupied before the beginning of Period III in the Rouse (1939: 57-72) time scale. No prepottery sites corresponding to Period I in the rest of the Indies have been discovered as yet in Jamaica nor any of the distinctive flint, stone, and shell implements characteristic of the Ciboney. Of the 3 main Arawak groups, the Igneri, the Taino, and the Sub-Taino, only the last appear to have reached Jamaica.

Thus, Period II, which marks the entrance of the Igneri from South America and their expansion into the Antilles, is also unrepresented in Jamaica. Most of the Jamaican archaeological remains appear to belong to the latter part of Period III. DeWolf's (1953) Little River materials are the only evidence we have for possible occupation earlier in this Period. Period IV, which is characterized by the Carib invasion and the expansion of the Taino at the expense of the Sub-Taino, seems to have been only a distant echo in Jamaica. While the Jamaican Arawak knew and feared the raiding Carib, as all the historical accounts make abundantly clear, the Carib left no lasting traces on the island. Neither is the cultural elaboration of the Taino, which was taking place during this time in Haiti and Puerto Rico, evident in Jamaica. It would appear that, once having reached the island, the Jamaican Sub-Taino continued the culture they brought with them with relatively little change or advancement until the arrival of the Spaniards. Certainly the 2 salient characteristics of Jamaican culture which emerge from this archaeological survey are, first, the relative poverty of the culture, particularly in comparison with later Taino cultures of the Greater Antilles and even in relation to the Cuban Sub-Taino groups, and, secondly, the apparent stagnation, or, at least, very slow rate of cultural change which took place on the island over a period of several hundred years. In this respect, Jamaica would seem to be a prime example of what Kroeber (1948: 418) has termed "peripheral retardation."

The salient features of Arawak culture in general and the Sub-Taino culture in particular have been too well summarized by Rouse (1948: 495-567) to be further analyzed here. As Rouse (1948: 542) has pointed out, the great bulk of material written by the early explorers on the Arawak deals with the natives of Hispaniola and no attempt was made by these authors to distinguish between the cultures of the Taino and Sub-Taino groups. This paucity of authentic ethnographic or historical data is particularly evident in regard to the Jamaican Arawak. It will be, therefore, largely the responsibility of the archaeologist to fill in the present great gaps in our knowledge.

Certainly the most puzzling problem that future investigators must try to solve is the reason for Jamaica's cultural retardation. This

cannot be explained solely by the peripheral position of the island in the greater Antilles. It is true that Jamaica was somewhat out of the way of the main stream of population movements and cultural diffusion in the West Indies but the preconquest peoples of the island were in no sense severely isolated from their neighbors. There is ample historical and archaeological evidence that considerable contact took place between all the islands before the coming of the Spaniards and Jamaica was well situated to receive any cultural stimuli from either Central or South America. An explanation solely in terms of ecology is obviously inadequate. Jamaica offered a variety of natural resources, soils, and potential food supplies equal or superior to any island in the West Indies. Nor are the natural barriers sufficiently formidable in view of the known seafaring ability of all the Arawak groups. The fact remains that, viewed at present, Jamaican culture appears to have been a somewhat unique and indigenous configuration which was unusually uniform in content and which changed very little and very slowly during its span of existence.

While any number of possible explanations could be advanced as to why the developed ceremonialism, advanced technology, and more complex social and political organization typical of the Antillean culture center failed to diffuse to Jamaica, the ultimate answers are probably to be found in internal features of the aboriginal culture itself. How many of these patient archaeological research can reveal remains to be seen.

The crying need at present in Jamaican archaeology is for detailed stratigraphic excavation in as many undisturbed sites in as many different parts of the island as possible. Only when this has been accomplished can we assess Jamaican culture in its proper perspective.

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DEVELOPMENT OF PERUVIAN COASTAL TIAHUANACOID STYLES*

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IN many works on Peruvian archaeology with their necessary emphasis on pottery styles as diagnostic elements of cultural development and change, one is often struck by the seeming confusion and number of styles in the Tiahuanacoid or Middle periods, and the resulting number of conflicting names for chronologically affiliated strains. This paper is an attempt to clarify in part this confusion and also an attempt to explain why it should exist and undoubtedly will continue to exist for some time to come, or at least until a great deal more field research has been completed on the coast of Peru.

In spite of recent advances in architectural and textile analysis, ceramic styles still remain the soundest diagnostic elements for tracing pre-Columbian Peruvian culture sequences. In a cultural development such as that of ancient Peru, with its highly diversified regional civilizations, whose cultural manifestations from time to time are influenced by "horizon styles," it is more than advisable to be able to trace culture sequences and their relationship to one another. Future absolute dating and detailed analysis in this way can be put into a proper frame of reference and cross reference. Although strong inferences may be drawn from certain areas where detailed study has taken place, such as the Chicama valley (Larco 1948), Virú valley (Ford and Willey 1949; Strong and Evans 1952), Ancon area (Strong, Willey, and Corbett 1943; Willey and Corbett 1954), and the Nazca (Rio Grande) valley (Strong 1954), so many important regions of the Peruvian Coast have not yet received the field research they merit that it is still difficult to present culture sequences for the coastal regions in general with any real degree of assurance. However, recent excavations and surveys have indicated that there are many as yet unknown regional styles and greater intervalley stylistic differences than had been previously contemplated, especially during epochs when the coastal regions were *not* united either religiously, politically, or stylistically, thus tending to make general inferences rather risky when drawn from a study of a single valley.

* The author is deeply indebted to William Duncan Strong for suggesting this article and his kindness and cooperation in making available the material from the Columbia University share of the Virú Valley Project and also the photographs and collections of the 1952-53 Columbia University Nazca-Ica Expedition.

Hence, the analysis of ceramics of epochs when some fusion is found, such as the Tiahuanacoid, becomes of great importance as providing a measure of cross reference. The Tiahuanacoid periods are of special importance in this context, linking as they do the Formative and Regional Florescent epochs with those of the great kingdoms and confederations and of the development of the Inca Empire. Roughly speaking, the Coastal Tiahuanacoid periods may be defined as those occupying the time from the first strong coastal appearances of highland, Tiahuanaco-influenced stylistic manifestations to the emergence of the ultimate pre-Inca coastal styles such as Chimú, Chancay, and Chincha-Ica. Another reason for the importance of these periods is that architectural development, stylistic change, and depth of associated refuse would seem to give these periods a considerable time depth. Recent radiocarbon readings (Johnson 1951: 37-49), giving us late Mochica dates of around A.D. 150, tend to push the beginnings of the Tiahuanacoid periods back some hundreds of years, since Strong (Strong and Evans 1952: 205) has shown Tiahuanacoid I overlying Mochica. Viewed in this light, their inception could easily have been as early as A.D. 500, thus providing more evidence of their long duration, as the epoch of Kingdoms and Confederations has its beginnings around A.D. 1200.

A third measure of the importance of the Tiahuanacoid periods is their wide distribution. Evidences of Tiahuanacoid influence have been found on the Pacific littoral from the north coast of Chile to the Lambayeque region of Peru some 250 miles south of the Ecuadorian frontier, a distance of approximately 1600 miles. Over this great distance, the Tiahuanacoid influences appear in varying degrees of strength and purity and combine with local styles to a similarly varying degree. It is precisely this variation and fusion with local styles, when combined with a hitherto unavoidable lack of knowledge of many local styles, that has produced a great deal of the above-mentioned confusion. When the fact is taken into consideration that in many quarters considerable uncertainty exists about exactly what is meant by coastal Tiahuanacoid, the confusion becomes inevitable.

Wendell C. Bennett, before his untimely death in 1953, did much to clarify the highland, or Tiahuanacoid influences appearing on the coast of Peru. Bennett (1953), in his typing of the ceramics encountered in his excavations at the important Tiahuanacoid center of Wari in the Peruvian Sierra, isolated 2 types that appear most strongly on the coast. At the same time he proposed the hypothesis that Wari, and probably other similar Peruvian centers, were the foci for the diffusion of Tiahuanacoid styles to most of the Peruvian coast, rather than a spread direct from the Lake Titicaca basin itself. This manner of diffusion, heretofore suspected by some, but not yet generally taken into account before Bennett's work, is another factor in the difficulty of understanding the coastal Tiahuanacoid manifestations. Still another point that may arise before the whole picture is clear is that Schaedel (personal communications, 1953-54), from his work on the Chilean coast in 1953 and 1954, has come to the tentative conclusion that the Tiahuanacoid spread to that area came directly from the region of Tiahuanaco, and that this may hold true for the southern part of the Peruvian coast as well, that part from Camaná to Tacna. Because of the geographical situation of this area (Stumer 1954) the author is inclined to agree with Schaedel. There could then be a situation in which the larger and more artistically important section of the Peruvian coastal Tiahuanacoid culture area got its highland stylistic impetus indirectly from Tiahuanaco via the Peruvian intramontane basins, picking up bits of local highland cultures as it came, while another less important section got its impetus directly from the Titicaca basin foci. In other words, the styles of the one area could and should be termed Tiahuanacoid, while those of the latter would probably be more aptly called coastal Tiahuanaco in order to point out the difference between the direct and indirect diffusion. This part of the discussion is still highly academic, since, although the Tiahuanaco influence has been recognized in the southern region, no work done there has yet been published and those styles have still to be isolated.

To return, therefore, to the Tiahuanacoid styles already known, Bennett isolates 2 strains most strongly influencing the coast. These are: Wari Polychrome Fine (Bennett 1953, Figs. 14, 15; Pls. 3-6), and Ayacucho Polychrome (Bennett 1953, Figs. 17, 18; Kroeber 1944, Pl. 39). The Wari Polychrome appears most definitely

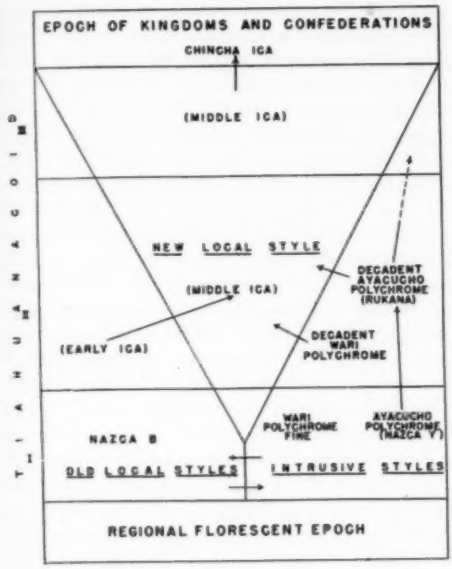

FIG. 1. Development of South Coast Tiahuanacoid styles.

to be the influencing style for most of the well-known Tiahuanacoid manifestations of a major part of the Peruvian coast, while the Ayacucho Polychrome style seems not to have made its influence felt except in that region generally known as the South Coast, that is, from the Chincha valley to Atico. However, in this region *both* the Wari and Ayacucho Polychromes exert great influence on the coastal styles, thus causing even more stylistic confusion in this area.

The Ayacucho style shows an amazing number of resemblances to the style which has been called Nazca Y by Kroeber and others. This style has been found by Kroeber and Strong in various valleys of the Nazca region and by Strong in the Ica valley. Kroeber (1944, Pls. 3-6) illustrates several pieces closely resembling the Ayacucho Polychrome ware, giving their provenience as the upper Majes valley to the south of the Rio Grande (Nazca) valley. For the present, the foregoing is the hypothetical range of distribution of the style on the coast. However, surface reconnaissance has demonstrated the likelihood of a further extension to the Pisco and Chincha valleys just to the north of the Ica. Strong (personal communications, 1953-54), from his excavations at the Huaca del Loro site in the vicinity of Nazca, is inclined to believe that the Ayacucho Polychrome style is coastal in origin, probably a late offshoot of the true Nazca styles, and passed to the Wari region from the Nazca area at a time just before the Tiahuanacoid "invasion" of the coast. There is ample evidence of a good deal of interchange between the 2 above-mentioned regions at such a time. Strong's hypothesis, then, could well be a plausible explanation of the limited spread of Ayacucho Polychrome, as not being a true Highland, Highland-diffused style. It does not, however, explain the extremely decadent aspect of both Nazca and Tiahuanacoid designs which appear on the ceramics, as well as the general disappearance of the polychrome tradition shared by both the Nazca and Wari styles in their classic periods. The final definition of this problem must await further excavation, both on the South Coast and in the Mantaro Basin, in which Wari is located. Such excavation is most necessary, as the Ayacucho Polychrome-Nazca Y style is of extreme importance to the South Coast Tiahuanacoid periods.

At the Lima Conference in January of 1953 (Anonymous 1953) the coastal Tiahuanacoid periods, or the epoch of Great Fusion, were separated into 3 main divisions: Tiahuanacoid

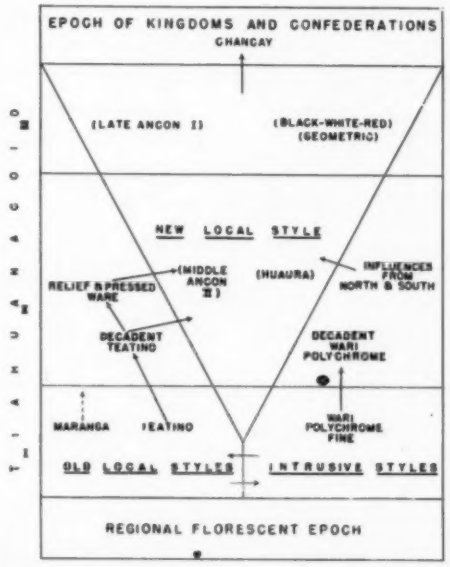

FIG. 2. Development of Central Coast Tiahuanacoid styles.

I, II, and III. This division was due in part to the results of Schaedel's work on the North Coast on the architecture and ceramics of the epoch of Great Fusion in that region. Unfortunately, but for reasons that the author hopes will become apparent before the end of this paper, a clear definition of the divisions between Tiahuanacoid I, II, and III could not be made at that time. It was felt, however, that there were certain well-defined milestones along the route of the development of the Tiahuanacoid styles that could not be overlooked as pointing out changes of significance. It should be apparent that in the stylistic development within any one epoch, especially one of fusion and a horizon style, that any hard and fast divisions must be, at least in part, arbitrary. However, since the 3 divisions are intended primarily for purposes of chronological sequences and cross dating, a certain amount of stylistic "fuzziness" at times of transition is not only permissible, but inevitable (Bennett 1939: 138-9; Kroeber 1944: 111-4). It would be illogical and nonsensical to cherish the hope that, merely to aid the archaeologist, styles would have changed completely and abruptly in any area in a short period of time!

The styles of the Tiahuanacoid I period on the South Coast are referred to in whole or in part as: Nazca Y, Rukana, Epigonal, Andino del Sur, Pacheco, Kollawa, and Chanka (Table 1). It should be here pointed out that within this large mixture of stylistic terms, all meaning the same thing from a chronological point of view, are found 2 strains which the author feels are of supreme importance for the clarification of the epoch. Perhaps it would be better to say that the ceramics of all these various styles or types can be separated into 2 main divisions, and these divisions hold true for Tiahuanacoid I along the entire coastal range of its distribution. These divisions are: (1) a ceramic almost purely highland in style, be it either Wari Polychrome Fine or Ayacucho Polychrome derived, with very little blending with or influence from the pre-Tiahuanacoid local style (here Nazca B), and (2) a ceramic still almost purely local with just a few diagnostic elements of the highland influence. In other words, one of the salient points to consider in studying the ceramics of the Tiahuanacoid I period is the continuing comparative purity of local and intrusive strains. For example, Pacheco (Bennett 1946, Figs. 13, 14) is practically pure Wari Polychrome. Nazca-derived coastal influences are minor and have not yet measurably succeeded in softening or decaying the style. On the other hand, Nazca Y (Muelle and Blas 1938, Pl. 4 *a*) quite often succeeds in retaining a great measure of the purity of the coastal style, showing only minor highland influences in form, execution of design, and color.

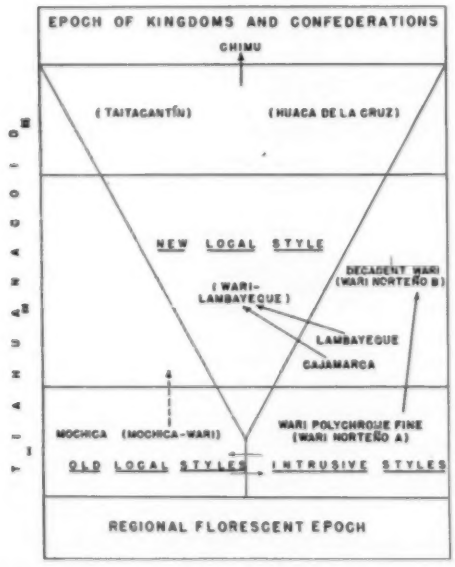

FIG. 3. Development of North Coast Tiahuanacoid styles.

The Tiahuanacoid I period on the Central Coast is simpler to identify, particularly because of the virtual disappearance here of the Ayacucho Polychrome strain. The ceramics, bearing a great resemblance to the Pacheco and Kollawa of the South Coast, are called by various names including: Coast Tiahuanaco, Coast Tiahuanaco A, Epigonal, Pachacamac, and Pachacamac A, and Middle Ancon I (Table 1), and are all derived from Wari Polychrome Fine (Bennett 1946, Pl. 39; Bennett and Bird 1949, Fig. 40, *upper half*). The South Coast-originated, Tiahuanaco-diffused, double-spout-and-bridge form is present, as are the kero-like cups and anthropomorphic collar jars so characteristic of coastal Tiahuanacoid manifestations. The polychrome tradition of the Wari Poylchrome Fine style (and also of the Nazca) has not yet begun to fade, and outside influences in general are confined to small style-softening hints derived from motifs of the

pre-Tiahuanacoid Maranga style of the Central Coast, that style also known as Cajamarquilla, Nievería, and Proto-Lima. Grave association at the author's 1955 excavations at Vista Alegre in the Rimac Valley confirms the coexistence of decadent Maranga with classic Tiahuanacoid I, while at the same time showing the still relative purity of both styles. The Peruvian government excavations at Ancon Necropolis in 1952-53 (Respaldiza 1952) showed the same association, while at the same time confirming Strong's and Kroeber's observations (Strong 1925: 148-52; Kroeber 1944: 43-5) about the Tiahuanacoid association of the Middle Ancon I Incised, or Teatino, style. It would appear, therefore, at least in sites of the Tiahuanacoid I period yet excavated on the Central Coast, that we are dealing again with 2 main strains, the intrusive and the local, the former being true Wari Polychrome-derived Tiahuanacoid and the latter being represented by 2 local regional styles, Maranga and Teatino. Doubtless, as other pre-Tiahuanacoid regional styles are discovered along with the Tiahuanacoid wares in these regions, the same pattern will hold true, while at the same time explaining same regional variations which have been puzzling students of the period.

TABLE 1. STYLISTIC ELEMENTS IN COASTAL TIAHUANACOID I DEVELOPMENT
(P. stands for Polychrome, and P. F. for Polychrome Fine)

Style	*Major Components*	*Minor Components*	*References*
SOUTH COAST			
Nazca Y	Nazca B	Ayacucho P.	Bennett 1946, Pl. 24
Rukana	Nazca B	Ayacucho P.	Muelle 1938, Pl. 30 *b*
Epigonal	Ayacucho P. Wari P. F.	Nazca B	Muelle 1938, Fig. 4
Andino del Sur	Alternative term for Epigonal		
Pacheco	Wari P. F.	Nazca B	Wassermann-San Blas 1938, Pl. 565; Bennett 1946, Figs. 13, 14; Muelle and Blas 1938, Pl. 33
Kollawa	Wari P. F.	Nazca B	Muelle and Blas 1938, Pl. 31 *a*; Bennett and Bird 1949, Fig. 40
Chanka	Ayacucho P.	Nazca B	Muelle and Blas 1938, Pls. 4 *a*; 29 *a*; 30 *a*
CENTRAL COAST			
Coast Tiahuanaco	Wari P. F.	Maranga Teatino	Bennett 1946, Pl. 39; Strong 1925, Pl. 46 *c, f, g*; 47 *b, d*; Kroeber 1925, Pls. 73 *b, d, g*; 74 *j, i*; 75 *h-o*
Coast Tiahuanaco A Pachacamac Pachachamac A	Alternative terms for Coast Tiahuanaco		
Middle Ancon I*	Teatino Maranga	Wari P. F.	Strong 1925, Pls. 46 *a, b, e, h, i, k, m*; 47 *a, b, e*
Middle Ancon I*	Wari P. F.	Maranga Teatino	Strong 1925, Pls. 46 *c, f, g, n*; 47 *b, d*
NORTH COAST			
Wari Norteño A	Wari P. F.	Mochica	Larco 1948: 38, Pl. 15; Kroeber 1925, Pl. 63 *a-e*
Mochica-Wari	Mochica	Wari P. F.	Larco 1948: 40, Pl. 78; Kroeber 1925, Pl. 67 *e*

* This style contains both strains referred to in the text.

The Tiahuanacoid I period on the Central Coast, because of the lack of such a number of associated styles and substyles as are found on the South Coast gives a much better view of the beginning of the blending of 2 main strains to form the "ancestor" of the local regional style to come. This blending, beginning in Tiahuanacoid I, becomes the dominant characteristic of Tiahuanacoid II in all 3 coastal regions. In other words, while stylistic fusion is *not* a keynote of Tiahuanacoid I, its earliest manifestations can be seen therein, and they become widespread and all-important in Tiahuanacoid II.

On the North Coast, the tremendous strength of the pre-Tiahuanacoid Mochica style makes for an outstanding example of the pattern already noted for Tiahuanacoid I. Larco (1948: 37-40, Pls. 15, 16) points this out in perhaps the soundest bit of nomenclature yet given to Peruvian ceramic styles when he refers to the 2 strains as Mochica-Wari (Mochica with Wari influence) and Wari Norteño A (first appearance of Wari-derived ceramics on the North Coast), while emphasizing the coexistence of the two. The Sierra-derived ceramics found by Uhle on a terrace of the Huaca del Sol in the Moche valley (Kroeber 1925, Pl. 63 *a-c*) are also typical of Wari Norteño A or classic Coast Tiahuanacoid I. The Wari Polychrome Fine influence on Mochica seems to be mainly one of bringing a bit of the polychrome tradition to an essentially bichrome style, while at the same time the beginning of a breakdown in the great Mochica modeling tradition is seen. On the other hand, Mochica influence as seen in Wari Norteño A appears to be mainly confined to bringing about a greater emphasis on modeled ware than is generally found in Tiahuanacoid I ceramics of other regions.

The North Coast, however, affords a fine example of that confusion mentioned earlier. In spite of the clarity of the picture for "Mochica-land," the remainder of the North Coast is obscure indeed for the Tiahuanacoid periods. Mochica domination and stylistic saturation has been proven for only 5 North Coast valleys (Chicama to Santa), but the pre-Tiahuanacoid styles for the important Huarmey-Nepeña region to the south and the equally important Jequetepeque-Motupe region to the north are as yet unknown. Much more field work is needed on the North Coast to isolate hitherto unknown pre-Tiahuanacoid local styles as well as to trace the northward diffusion of the Tiahuanacoid influence. When Schaedel reports on his North Coast field work of the early 1950's he can do much to clarify this picture.

In the Tiahuanacoid II period, the pattern of development shown in Figures 1, 2, and 3 becomes most apparent. During this time the name, "Fusional," generally given to the whole Tiahuanacoid epoch, is most apt. The purity of the 2 strains, pre-Tiahuanacoid local and Wari Polychrome-derived intrusive, starts to decline to a marked degree, while some local styles die out completely. Elements from practically all styles within a given region, and often from outside as well, appear and blend with both main strains, decaying and transforming the two. There is a general shaking up and sifting out of intrusive and local stylistic elements and the beginning of their ultimate blending into the eventual final regional styles of the epoch of Kingdoms and Confederations. In Tiahuanacoid II the ceramic picture is the most confusing of all, as there now are 3 main strains to contend with: decadent intrusive, decadent pre-Tiahuanacoid local, and incipient new regional. The artistic result of all this thrashing about would be an expected decline in quality and a rash of ill-conceived stylistic mergers. Such an expectation is thoroughly justified, for Tiahuanacoid II exhibits some of the most bone-chilling artistic abortions to be found in any ancient art! True, here and there are encountered some fairly happy stylistic marriages and an occasional decadent piece still retaining some beauty and dignity, but in general the Tiahuanacoid II period ceramics are best left by the art lover to the unwilling archaeologist! As a note apart from the theme of this piece, Tiahuanacoid II textiles and small artifacts are often, strangely enough, among the loveliest encountered in Peruvian prehistory.

On the South Coast, the Tiahuanacoid II styles still are called by a great variety of names. Among them are: Nazca Y, Rukana, Early Ica, Ica Epigonal, and Middle Ica. Some of the Middle Ica ware rightly belongs, however, to Tiahuanacoid III. It is extremely difficult to point out by present nomenclature Tiahuanacoid II stylistic development on the South Coast, since many of the stylistic names listed above seem to be catchalls for wares

showing all the strains existent at the time. Also, the pre-Tiahuanacoid local styles of the extremely important Chincha and Pisco valleys are still unknown. Table 2 contains an attempt to clarify this picture. Still another factor is that various components of the pre-Tiahuanacoid Nazca style persist for a great time in the South Coast region. Some of these pieces even occur in association with pure Tiahuanacoid III ceramics and might well be stylistically "Nazca Z," as both chronologically and artistically they are surely the end!

The Central Coast, although complicated in the Tiahuanacoid II period, is again simpler than the South Coast. The Maranga style has died out, leaving only a small legacy of some design and form elements to the developing new regional style. The Middle Ancon I Incised, or Teatino, style is practically dead. There are a few decadent incised, mainly utility vessels remaining, but the style has generally developed into quite a virile strain of pressed ware (Strong 1925, Pl. 44 *G, I*; 45 *B, I*), known locally in Peru as Pativilca. This strain persists until the final crystallization of the Chancay style to come. The Wari Polychrome Fine strain has decayed to a large degree and has accumulated a number of influences from other areas, notable among them one from the Huarmey-Supe region to the North. It is this strain that Tello called Sub-Huaylas. The polychrome tradition is dying, and during the course of the Tiahuanacoid II period disappears entirely, leaving behind it only some of its design elements. These often appear in extremely simplified and sometimes well-nigh unrecognizable form. The local style, eventually to emerge in the form of the well-known Chancay Black-on-White, is forming itself out of various elements derived from its predecessors as well as others which develop at this time. A large percentage of the ware which Strong (Strong 1952, Pls. 44 *A, B, D-F, H-M, P, R*; 45 *A, E, H, L*) calls Middle Ancon II (Table 2) can be placed in this category, as well as much of the locally named "Huaura" style (Mejia X. 1953). What is happening in the important southern part of the Central Coast at this time, that is, Lurín-Cañete, is still a mystery

TABLE 2. STYLISTIC ELEMENTS IN COASTAL TIAHUANACOID II DEVELOPMENT
(P. stands for Polychrome, and P. F. for Polychrome Fine)

Style	*Major Components*	*Minor Components*	*References*
SOUTH COAST			
Nazca Y	Ayacucho P.	Nazca B	Bennett 1946, Pl. 24 (bottom right)
Early Ica	Ayacucho P.	Nazca B	Muelle and Blas 1938, Pl. 32 *b*; Bennett 1936, Pl. 44 *a, b*
Ica Epigonal	Alternative term for Early Ica		
Middle Ica*	Ayacucho P.	Nazca B	Kroeber and Strong 1924, Figs. 6-11
Middle Ica*	Nazca B	Ayacucho P.	Kroeber and Strong 1924, Figs. 12-16; Pl. 29 *e*
CENTRAL COAST			
Middle Ancon II	Wari P. F.	Teatino	Strong 1925, Pls. 44 (all); 45 *a-c, e*
Sub-Huaylas	Wari P. F.	Teatino	Muelle and Blas 1938, Pls. 39 *a*; 40; 41
NORTH COAST			
Wari Norteño B	Wari P. F.	Mochica	Larco 1948: 41, Pl. 79
Lambayeque	Lambayeque	Wari P. F.	Bennett 1939, Fig. 20 (all); Muelle and Blas, 1938, Pls. 56, 58
Wari-Lambayeque	Lambayeque Mochica	Wari P. F.	Larco 1938: 45, Pl. 81; Muelle and Blas 1938, Pl. 59

* This style contains both strains referred to in the text.

and must await excavations in the area. When these are made, however, the pattern will doubtless be seen to be similar.

On the North Coast, in Tiahuanacoid II, the same changes are taking place, although here complicated by the influences of 2 strong styles not yet fully understood. One is Lambayeque, probably coming from some focus in the Chiclayo area, and the other Cajamarca, coming from the north highland basin of the same name. The former makes its greatest contribution to the emerging, ultimate, Chimú style, while the latter's influence is more fleeting and serves mainly as a confusing factor while at the same time pointing out the fusional nature of the Tiahuanacoid II period.

Among the North Coast Tiahuanacoid II styles are Wari Norteño B, Lambayeque, Wari-Lambayeque, Santa, and a portion of the Middle Moche ware. Wari Norteño B refers mainly to ceramics showing the decadence of the intrusive Wari Polychrome strain. The other terms generally refer to the usual mixture of strains found at this time. Some show to a great degree the final breakdown of the preceding local Mochica style; others, a pretty unhappy mixture of strains presaging, however, the fine Chimú style yet to come (Table 2). An interesting footnote to the development of the period on the North Coast is the seeming comparative weakness, chronologically speaking, of the Wari Polychrome influence in this region. Two possible explanations come to mind. One, the greater distance from the stylistic focus, and two, the tremendous virility of the Mochica culture which antedated the Tiahuanacoid spread. It may well be a combination of these factors which provides the answer, as strength of preceding *style* alone does not seem to be enough. Witness the South Coast, where the Nazca style, although itself possessing great vitality, does not prevent the long life of, and general saturation of the region by, the intrusive highland influences.

The Tiahuanacoid III periods (Table 3) exhibit the same similarity to one another, regionally speaking, as the two preceding, but the general aspect of Tiahuanacoid III is entirely different. There seems to be practically an end to the experimentation and confusion. A return to a transformed version of the regional development which preceded the highland intrusion can be plainly discerned. The intrusive influences are almost dead and the final regional styles have almost completely crystallized. True, certain former influences still crop up from time to time as witness the Nazca "Z" pieces mentioned above, some broken down Central Coast kero forms showing vestiges of highland designs, and in the North revolting examples of what remains of the earlier, powerful, anthropomorphic collar jars (Bennett 1946, Pl. 41 C). On the South Coast, the Middle Ica style (Bennett 1946, Pls. 44 *D*; 45 A), soon to become the well-known Chincha-Ica ware, has practically finished its absorption of Nazca and highland influences, while the remnants of these two are fast disappearing. The polychrome tradition has now ended all along the coast. What remains is an interesting general use of black, white, and red in design. While the basing of "horizons" on simple color techniques such as this can be misleading in the extreme, and while the Black-White-Red ceramics of Tiahuanacoid III differ greatly regionally, the general use of this color scheme at this time is extremely fascinating and would merit future study.

On the Central Coast, the Huaura style has reached the Black-White-Red stage in the main, and the local pressed ware and highland-influenced strains are on their last legs. In present excavations by the Peruvian Government at Ancon Necropolis, a number of white vessels, that would not be out of place in the classic Chancay style to follow, have turned up in grave association with fine examples of Tiahuanacoid III. Lest this occasion any doubt as to relative chronological position, the author [illegible]s to say that Ancon grave stratigraphy [illegible]sively places classic Chancay at a later

[illegible]n the North, the modeled blackware style, [illegible] to become Chimú, has almost crystallized, although the North Coast version of Black-White-Red (Bennett 1946, Pl. 41 *A-D*) continues to accompany it. That part of the previous highland influences in form and design that will become a component of the Chimú style is now virtually fully integrated. Simultaneously the same highland influences are seen on the Black-White-Red ware in their most diffused and decadent forms. Tiahuanacoid III somehow gives the impression of having had a short time depth, at least compared to Tiahuanacoid II. It seems to be a period more of consolidation than of continuing fusion and change. To aid the reader in

relating the above to existing nomenclature, the following typical Tiahuanacoid III stylistic manifestations may be pointed out: for the South Coast, Middle Ica; for the Central Coast, some of Middle Cañete, Pachacamac D, Late Ancon I, and Black-White-Red Geometric; and for the North Coast, Middle Moche IIC, Huaca de la Cruz, and Taitacantín. Some of these terms are alternatives. They are merely set forth here as illustrative of both the typical styles of the period and the existent confusion in the nomenclature of Peruvian archaeology.

Taking into account all of the above, the general pattern of the development of the Coast Tiahuanacoid styles would seem to be somewhat along the following lines (Figs. 1, 2, 3). At first, one or more intrusive highland strains come in contact with one or more firmly established local strains in each of the 3 coastal regions. During this initial period, the local and intrusive strains keep their separate identities to a great degree, while at the same time they show their coexistence by grave association. As the initial period progresses, the 2 strains begin to break down and decay, and at the same time give some of their various design and form elements to the inception of the new local style to come. Out of these stylistic gifts, plus regional developmental efforts, the final local style will emerge.

The second phase is that of the almost complete decline of the former local style or styles as well as of the intrusive strains. At this time, the fusional currents between the 2 stylistic elements are at their flood. The obvious upheaval now taking place in the old Regional Florescent structure with its attendant breaking down of previous geographical and/or political divisions is bringing with it a merger of many strains that formerly had been distinct. Add to this the fact that many of these strains have yet to be discovered and typed, in their pre-Tiahuanacoid form, and the confusion mentioned at the beginning of this article is at least partially explained.

The final stage seems to be one of elimination of the last vestiges of the 2 main original strains, local and highland intrusive, in anything approaching their pure forms. There is also the consolidation of various original elements with those having arrived during the previous period, thus achieving a sound and almost completely formed basis for the future regional style. This stage is also one of elimination of many design and form elements which were prominent during the extreme fusion of the second stage. At this time as well, form analysis of ceramics reveals a tendency to go back to a number of forms in general use during the pre-Tiahuanacoid days and in comparative eclipse during the fusional epoch's height. This tendency merits a great deal of future study, which, however, must be left until greater knowledge of the pre-Tiahuanacoid regional styles is possessed.

TABLE 3. STYLISTIC ELEMENTS IN COASTAL TIAHUANACOID III DEVELOPMENT
(P. stands for Polychrome, and P. F. for Polychrome Fine)

Style	*Major Components*	*Minor Components*	*References*
SOUTH COAST			
Middle Ica	Chincha	Ayacucho P. Wari P. F.	Bennett 1946, Pl. 44 *c*; Kroeber and Strong 1924, Pls. 32 *a, c, f, h*; 33 *b, d, f*; 34 *d, e*
CENTRAL COAST			
Late Ancon I	Chancay	Wari P. F.	Strong 1925, Pl. 43 *i-p*; Bennett 1946, Pl. 40 *e-h*
Black-White-Red Geometric	Alternative term for Late Ancon I		
NORTH COAST			
Middle Moche II C	Chimú	Wari P. F.	Bennett 1939, Figs. 9 *c-e*; 10 *d, e, h, i*
Taitacantín	Wari P. F.	Chimú	Bennett 1939, Figs. 9 *b, f, g*; 10 *a-c*

This last point, that of the necessity for a thorough knowledge of the coastal pre-Tiahuanacoid styles, is one which cannot be overstressed. It is important not only to the study of the Tiahuanacoid periods themselves, but also can serve as a guidepost in the study of the type and diffusion of the Tiahuanaco influence which is such an important one in Peruvian prehistory. In the study of the Tiahuanacoid periods, the local preceding style plays a large part in the development during the fusional epoch. As can be seen from points previously made, the strength of the early local style determines to a large part the direction of fusional development as well as the make-up of the ultimate regional style. It would also seem that the stronger the local style was, the longer it persisted during the Tiahuanacoid periods in mutated and decadent forms. When these are encountered in field research without associations, they tend to create a great deal of chronological uncertainty.

The author hopes that he has here made a case for 2 lines of endeavor in the future: (1) a great deal more field work in the Regional Florescent civilizations not yet fully known; and (2) a reappraisal of present Tiahuanacoid nomenclature. There is no quarrel with the use of distinctive terms for ceramic manifestations when one is primarily concerned with the study of the ceramics themselves. This is merely a plea for a concerted effort among Peruvianists to correlate such terms with their chronological position in the framework of the development of Peruvian prehistory. When this is made, a great stride forward will have been taken, and the future field work will serve to round out a clearer picture. Actually, the developmental pattern itself of the coastal Tiahuanacoid periods would appear to be a fairly straightforward one along the lines suggested above.

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PLAINS-PROMONTORY RELATIONSHIPS*

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A RECONSIDERATION of material collected from Promontory Point, north central Utah (Steward 1937) suggests that Promontory-Plains relationships may be closer than hitherto realized. Moreover, while several traits of the Promontory culture occur in more than one Plains archaeological complex, some are limited to the Dismal River aspect, suggesting the possibility of close ties between the Dismal River and Promontory peoples. Steward noted that a few traits (hoop and dart game, hand game bones, side notched projectile points, end scrapers) represented in the Promontory culture were also found in the Plains. Hill and Metcalf (1941: 188, 197) pointed out that tubular steatite pipes and blunt bone "punches" or "flakers" occurred in both Promontory and Dismal River. This paper enumerates still other resemblances.

The worked stone of the Promontory culture is remarkably similar to that of the Plains in general and Dismal River in particular. End scrapers, extremely common in the Plains but uncommon in the Great Basin, occur in the Promontory assemblage. One specimen (Steward 1937, Fig. 28 *e*) has a carefully worked tang or graver point at one end of the scraper edge. In the Plains such tanged scrapers have thus far been reported only from Dismal River (Champe 1949: 289), and may prove diagnostic of that complex. Another trait common to both Promontory and Dismal River, but less diagnostic, is the presence of a cutting, scraping, or chopping edge on otherwise roughly shaped or unshaped pieces of flint, quartzite, or other stone. Promontory projectile points represent a wider variety of shapes than do Dismal River points, but most Dismal River types occur in the Promontory assemblage. The use of tubular steatite pipes is a trait shared by Promontory and Dismal River. The Promontory assemblage contains sandstone arrowshaft smoothers which are common throughout the Plains and elsewhere, and incised stone tablets which are lacking in Dismal River but occur in other protohistoric Plains complexes such as Lower Loup (protohistoric Pawnee) and Oneota, and in historic Pawnee (Wedel 1938: 9). Finally, the general appearance of Promontory stonework, with its wide variability in quality of workmanship, is reminiscent of Dismal River.

The majority of Promontory potsherds are tempered with large pieces of limestone, in which respect they differ radically from Dismal River pottery. The remaining Promontory sherds, however, are tempered with fine quartz or sand, and in some cases mica is included. Many of these are well within the range of

* This paper was read in essentially its present form at the 1956 Annual Meeting of the Society for American Archaeology.

Dismal River pottery. The paste in the primarily sand-tempered Promontory sherds may be slightly more laminated than that of most Dismal River pottery, or than that of the coarser, limestone-tempered Promontory pottery.

The thickness of the 2 wares is about the same. Promontory pottery is usually black, although occasional sherds are brown, and many are encrusted with soot, traits also found in Dismal River. Decoration on the outside of vessels, although rare in both complexes, seems to be slightly more common on Promontory ware. Thickened lips, with incised and punctated decoration, which Steward found to be unique to Promontory ware in the Great Basin, is characteristic of Dismal River pottery also. Vessel shapes and sizes are similar; possibly Dismal River vessels have more pointed bottoms. Handles are lacking in both complexes.

Bone artifacts present in Promontory and in the Plains (most occur elsewhere as well) are several forms of bone awls, tubular bone beads, and knives or spatulas (some showing red paint) made from sections of scapulae. The blunt punches or flakers which occur in both Promontory and Dismal River are apparently unique to Dismal River in the Plains. The large amount and proportion of bison bones at Promontory sites, especially at Promontory Cave 1, indicates a greater dependence upon bison than was true of other Basin complexes. The Dismal River people, too, were primarily dependent upon bison.

FIG. 1. Bison metapoidal fleshers from Promontory Point, Utah.

The University of Utah Museum of Anthropology has in its collection of Promontory material a type of bone artifact hitherto unreported from the Promontory culture. This type of artifact, the bison metapodial flesher with serrated blade, is represented by 2 specimens. Stephen D. Durrant, Professor of Biology, University of Utah, identified these specimens as *Bison bison*. Both are from Promontory Cave 1 and were collected along with material reported by Steward (1937). The complete specimen (Fig. 1 *b*) (9353) was, according to the museum catalog, in the top foot of the fill, and the other (Fig. 1 *a*) (10366) was found about 1 foot below the surface, depths from which other Promontory artifacts were also obtained.

The better-made flesher unfortunately is broken, leaving only the blade portion. It has been scraped to a sharp, even edge and the fine teeth have been carefully cut. The scraping edge shows much polish from use, obliterating the tool marks which are evident elsewhere and consist of longitudinal striations. The thinning was apparently done with a stone implement. The second specimen is complete but much cruder. The bone has been split and broken at an angle but was not thinned or smoothed. The teeth are coarser, less deep, and farther apart; the scraping edge, however, shows polish from use. Since the epiphysis is present on the crude specimen and there is dried tissue adhering to the other, both, while in use, may have been articulated to the ankle bones which would have formed a handle. Both specimens are 3 cm. wide; the broken one is 12 cm. long and the complete one is 14 cm. long.

These fleshers are especially significant since in the central Plains they are considered diagnostic of the protohistoric period (Wedel 1940: 337) and in the Northern Plains Lehmer (1954, Fig. 54) found them associated only with complexes containing some white trade goods. The distribution of serrated fleshers on the historic level seems to be wide, but restricted to the area east of the Rocky Mountains (Wiss-

ler 1941: 64); they are known from essentially all Plains tribes, as well as from many groups farther east. Archaeologically, the bison metapodial flesher with serrated blade is known from such complexes as Lower Loup (protohistoric Pawnee), Pawnee, Dismal River, Mandan, and Stanley focus. Thus on the basis of present evidence, the occurrence of these tools in the Promontory assemblage is suggestive not only of Plains influence, but of a protohistoric date for the Promontory culture.

It should probably be pointed out here, however, that serration as such is not the diagnostic feature, for at one Plains Woodland site 2 broken fleshers or gouges with serrated points were found which, however, were made from metacarpal bones, probably of deer or antelope (Hill and Kivett 1941: 166). The heavier serrated bison metapodial fleshers are associated with the intensive working of heavy hides. On the historic time level serrated metal fleshers made their appearance.

The identification of the Dismal River people as Plains Apache is now generally accepted (Champe 1949: 291; Wedel 1949: 329). The typological similarities between Promontory and Dismal River, therefore, strengthen Steward's suggestions that the Promontory people may have been Athabascan (Steward 1940: 474). Dismal River material has been found as far to the northwest as southeastern Wyoming, while Promontory material, according to present evidence, is concentrated around the Great Salt Lake, with occasional manifestations elsewhere in northern Utah. The desirability of reconnaissance in the intervening portions of Wyoming and Utah becomes immediately evident. That area acquires even more interest from the fact that the University of Utah Statewide Archeological Survey, which by now has covered much of the state, has failed to discover evidence of Promontory material except in the north central portion. This suggests that if the Promontory people were Athabascans on their way south, they may have gone across southern Wyoming and down the eastern side of the Rockies rather than through Utah. It should be emphasized, however, that the Survey has thus far been largely extensive rather than intensive, and therefore a southern migration of the Promontory people in Utah cannot yet be completely ruled out.

Steward (1937: 83) suggested maximum and minimum dates for Promontory, placing it somewhere between the Puebloid occupation on the northern periphery (around A.D. 1000) and white contact (early 19th century). Enger (1950: 91) presents stratigraphic evidence that Promontory is pre-Shoshone. Both Enger (1950) and Steward (1940) discuss evidence suggesting an overlap of the Puebloid and Promontory occupations. This evidence is afforded by a few caves in which Promontory and Puebloid material were found together.

The typological similarities between Dismal River, which existed for about 50 years around 1700, and Promontory do not seem compatible with a date of around 1000 to 1150 for the latter complex. On the other hand, a later date for Promontory is incompatible with the postulated coexistence of Promontory and Puebloid cultures. I am not prepared to discuss the possibility that Puebloid manifestations persisted well after A.D. 1000 in northern Utah. In any event it does not seem that mixing of Promontory and Puebloid sherds in cave deposits should constitute indisputable evidence of contemporaneity.

No archaeological complex now known qualifies as an ancestor for either Promontory or Dismal River, but both have been considered as possible ancestors for Navaho (Keur 1941: 73-4). Obviously Dismal River and possibly Promontory are entirely too late for this. If Promontory covered a long time span in northern Utah, it is possible that its earlier manifestations might be ancestral to Dismal River (or other Athabascan groups) and its later ones contemporary with that complex. The presence of bison herds could well have provided sufficient inducement for either of these 2 peoples, so dependent on bison, to have lingered on in or revisited the northern Utah-southern Wyoming area. Steward, however, feels that the Promontory people spent only a short time in northern Utah — that they arrived abruptly and departed soon (Steward 1940). And in this connection it should be pointed out again that a short time span is also characteristic of the Dismal River aspect. In brief the Promontory culture as now known presents seeming paradoxes which can be resolved only by more excavation to determine time depth, as well as by extensive reconnaissance to discover where the Promontory culture came from and where it went. If Promontory came full blown from

the north, as mittens and moccasins seem to suggest (Steward 1940: 473), and already in possession of its pottery, this suggests an alternative northern, as opposed to a southwestern, origin for Dismal River pottery, and possibly other traits. Further research on Promontory, then, can be expected to contribute to the elucidation of both Basin and Plains prehistory, Athabascan migrations, and Basin-Plains relationships.

At the present, however, the best explanation of the Promontory material would seem to be that it represents an early protohistoric thrust by a buffalo-hunting Athabascan group into the Great Basin from the Plains.

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UNIVERSITY OF UTAH
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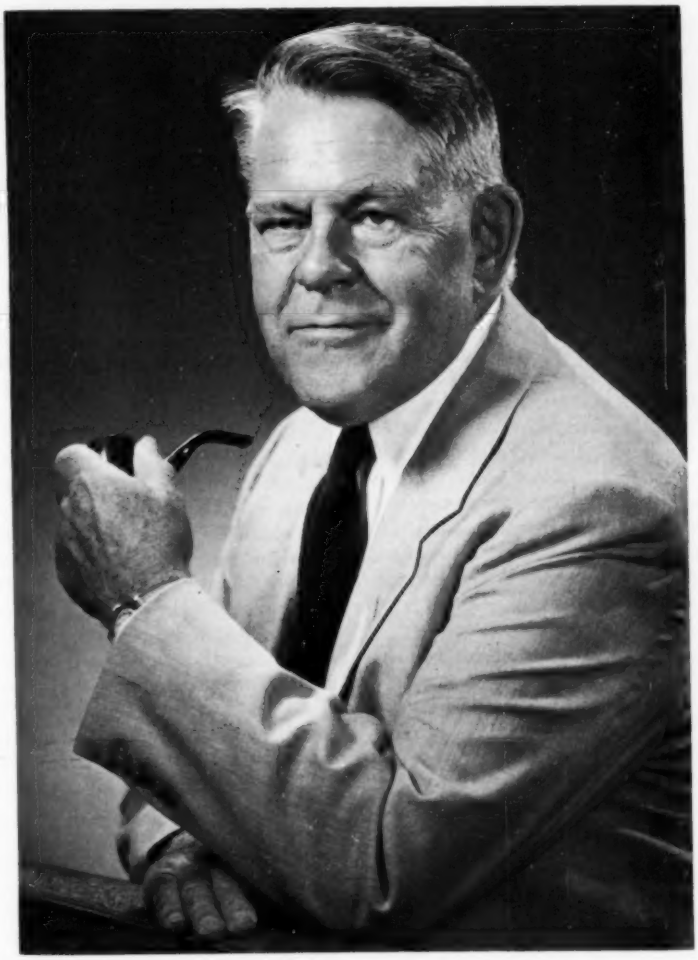
May, 1955



GEORGE FRANCIS WILL — 1884-1955

On October 2, 1955, at Bismarck, North Dakota, death came suddenly and unexpectedly to George Francis Will. A quiet, friendly, unassuming individual, in whom business acumen was happily combined with a scholar's devotion to learning, his passing removes from the Plains scene another key figure in anthropology. Such was his ability at self-effacement that few realize the extent of his accomplishments in the service of his fellow men. He covered his tracks well — yet one who

(continued on next page)

knew called him "one of the most important 'non-professional' archeologists we have ever had."

A life-long resident of North Dakota, and one of the state's outstanding citizens, George Will was born in Bismarck on November 8, 1884. From the Bismarck public schools, following a family tradition, he went to Harvard. Here he specialized in botany in preparation for the career he knew he would enter, but found time to study anthropology under Dixon. On graduation in 1906, he stepped immediately into the seed business established in 1881 by his father, Oscar H. Will, pioneer nurseryman of Bismarck; and in 1917 he became president and general manager of the firm. This business he headed for 38 years, serving actively until 2 days before his death. He participated widely in the business, civic, and cultural affairs of the community. A partial measure of the esteem in which he was held is the fact that he served for 30 years on the city school board, was for many years a member of the city library and zoning boards, the state park commission, and the state historical society board, and also functioned for long terms as chairman of the state corn show and as president of the historical society.

Despite the many demands of his business and civic responsibilities, Will was a keen student of the history, anthropology, and natural history of the northern great Plains. Intellectually, the ethnology and archaeology of the Upper Missouri remained his "first love." He developed an early and abiding interest in the great wealth of archaeological remains near Bismarck. As a junior at Harvard, he led an expedition in 1906 in excavations at the Burgois Double Ditch site. The report of this work, including important historical, linguistic, and ethnological data on the Mandan, still stands unique in anthropological publications for the Dakota region. His subsequent spare time investigations resulted in other papers calling attention to the antiquities of North Dakota; and he also tested the applicability of dendrochronological methods to timbers from Missouri River village sites of varying antiquity. Will was a strong force in the state's acquisition and development of several large and representative Indian village and quarry sites; and he encouraged systematic researches by qualified outside organizations where the state agencies were unable to do the work adequately. With activation of the federal water-control program on the Missouri, he enlisted the resources of the state historical society in archaeological salvage work, and served for several years — quietly, conscientiously, and effectively — as a member of the Committee for Recovery of Archaeological Remains. He was treasurer of the Society for American Archaeology from 1951 to 1953.

The heritage that American agriculture received from the Indian is, of course, well known to all who have had formal training in American anthropology. Nowhere, perhaps, is the nature of that heritage and the mechanism of its transfer better illustrated than in the work of George Will. With the Three Affiliated Tribes at Fort Berthold, the Mandan, Arikara, and Hidatsa, Will early established an intimate and lasting friendship. From this relationship he accumulated a wealth of information on the ethnography of these groups and developed a deep respect for their philosophy of life. On the practical side, he recognized the unique features of their long-established horticultural economy. Living near or at the northern margin of corn-growing in North America, they had developed crop varieties and methods peculiarly suited to the climatic rigors of the region. He wisely saw the possibilities of utilizing their experience and know-how in solving modern agricultural problems in the region. Here was a rare opportunity to combine his botanical training with ethnologic interests, and Will made the most of it.

His father had already shown the way. A handful of seeds received from a Hidatsa, Son of Star, in the 1880's became the Great Northern bean, now one of the leading field beans of commerce. In the years that followed, experimental work was carried on with corn, melons, and other vegetables obtained from the Indians. Some of this stock was badly mixed, and had to be unscrambled; this done, the Wills found themselves with basic strains all characterized by extreme earliness, hardiness, and drought-resistance. From these, in turn, were developed a series of varieties now well established in the regional farm economy. In this work, George Will had the active and close cooperation of such well-known men as the Rev. Gilbert L. Wilson, M. L. Wilson, George Hyde, and Melvin R. Gilmore. The full story would certainly be one of absorbing interest, but Will's own writings give only glimpses of what happened. Interestingly enough, the cata-

log of the Oscar H. Will Company still carries the names of many of the corn, melon, bean, and other varieties developed here from Indian stock; and as late as 1954 it advertised Will's Pioneer Indian collection including one packet each of the following: Hidatsa beans, Arikara squash, Omaha pumpkin, Mandan squash, Nuetta sweet corn. The information on native horticulture accumulated by George Will was published in 1917 in the classic *Corn Among the Indians of the Upper Missouri*, with Hyde as coauthor.

The basic importance and lasting value of Will's contributions to Northern Plains agriculture have not gone unrecognized. In 1940, he was awarded the Doctorate of Science by North Dakota Agricultural College; and in 1954 he received the 10th John Robertson Memorial medal in horticulture from the Horticultural Societies of the Dakotas.

On the personal side, George Will has been aptly characterized as an excessively modest and unobtrusive man. Because he did his work so quietly and selflessly, those of us not in constant touch with him never really got to know him as well as we should have liked to. His lovely hilltop home was always open to visiting archaeologists, whatever the hour of their arrival, their condition, or their number. His kindly hospitality and friendly good humor never failed, and they were fortunately shared by a congenial and vivacious wife of whom he was understandably very fond. All of these things leave us with memories we shall always cherish, as we respect his achievements.

These last, incidentally, include another side about which most people outside his immediate area knew little or nothing. George Will loved camping, mountain hiking, and the outdoor life generally. For more than 30 years, he was in the habit of taking long walks, varying from 7 to 15 miles, on every possible Sunday and holiday. Some of his observations and reflections were revealed in a series of short biweekly radio talks, later published in part. These run a wide gamut — grass, trees, Indian lore, the weather, sunsets, the seasons, the many changes in the land since his boyhood; and they betoken a close and sympathetic observer of nature along with a philosophic turn of mind. Mostly, he walked north and west of Bismarck; and he once observed that, "like Walden . . . this bit of North Dakota may furnish knowledge, pleasure, and amusement for all my years and those of generations to come."

In these rambles over the prairie bluffs and through the Missouri River woods of his beloved North Dakota, pipe in his mouth and dog at his side, George Will found a generous measure of the serenity that many seek and few find in our day.

WALDO R. WEDEL

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FACTS AND COMMENTS

THE LOCUS OF THE NATCHEZ PELVIS FIND

Some time between 1837 and 1844 Dr. Montroville Wilson Dickeson found a fossil human pelvis and bones of extinct animals in the vicinity of Natchez, Mississippi (Culen 1900: 113-5).

In 1846 Dickeson reported this find to the Academy of Natural Sciences of Philadelphia, stating in substance that the human bone was found at least 2 feet below 3 associated skeletons of Megalonyx in a "plateau of blue clay . . . that underlies the diluvial drift of Natchez" (Dickeson 1846: 106-7).

In 1889 Professor Joseph Leidy reported that the fossil bones associated with the Natchez pelvis consisted of "a nearly entire skull and other bones of Megalonyx Jeffersoni, teeth of Megalonyx dissimilis and Ereptodon priscus, bones of Mylodon Harlani, bones and teeth of Mastodon americanus, and teeth of Equus major and of Bison latifrons." (Leidy 1889: 9.)

In 1895 Dr. M. Thomas Wilson reported the results of a fluorine analysis of the Natchez pelvis and an associated Mylodon bone from which he concluded that the 2 bones were "substantially of the same antiquity" (Wilson 1895: 725). Thus, as early as 1895 there existed "an important objective argument in favor of the antiquity of man in America" (Stewart 1951: 392), a fact that remained unnoticed until recently rediscovered by T. Dale Stewart.

My interest in the Natchez pelvis was stimulated by Stewart's account of Wilson's investigations and by a recent statement of Sellards (1952: 90) that, "If the exact location from which Dickeson originally obtained the fossils can be re-located, valuable additional discoveries might be made."

Unfortunately the exact location of the Natchez pelvis find was not published by Dickeson. However, Sir Charles Lyell who visited the site in 1846 stated that the pelvis and other bones were found on the floor of a ravine, "now called the 'Mammoth Ravine,'" and were believed to have fallen there from a depth of about 30 feet beneath the surface of the ground (Lyell 1873: 238).

Fortunately, a little known but more specific account of the site was recorded by Professor C. G. Forshey of Natchez. During the 1840's Forshey undertook archaeological and geological investigations in Louisiana and Mississippi. He seems to have visited Dickeson's site shortly after the find was made. Forshey stated, "I examined the spot where the [Natchez pelvis] bone was found — Bernard's Bayou, just above the bridge, on the Pineridge road, two and one-half miles from Natchez. The material from which it was taken was a dark loam in the bottom of the thirty-feet bayou" (Foster 1878: 61).

In April, 1954, more than a hundred years after Dickeson's discovery, James R. Getz and I attempted to relocate the original site of the Natchez pelvis.

Shortly after arriving in Natchez we found out that in the 19th century it was the custom to figure distances from the courthouse. Thus Forshey's statement that the site was "two and one-half miles from Natchez" would probably mean that the site was two and one-half miles from the courthouse. Proceeding from the courthouse in the most direct route along Pine Ridge road we crossed Cemetery Bayou at a little less than 2½ miles and Mammoth Bayou at a little more than 2½ miles. Thus according to Forshey's description, either Cemetery Bayou or Mammoth Bayou would be what he called Bernard's Bayou. Since Lyell (1873: 238) also saw the site and stated it was in what "now is called the 'Mammoth Ravine,'" we concluded that the present day Mammoth Bayou was what Forshey called Bernard's Bayou and therefore, as Forshey had indicated, the locus of the Natchez pelvis find would be just above the bridge (upstream) where this bayou (ravine) crosses the Pine Ridge road. We examined this area without success.

Like other ravines in the vicinity of Natchez, Mammoth Bayou is a product of erosion. Speaking of Mammoth Bayou as it was in 1846 Lyell (1873: 238) states, "Though no less than seven miles long, and in some parts sixty feet deep, I was assured by a resident proprietor, Colonel Wiley, that it had no existence before 1812. With its numerous ramifications, it is said to have been entirely formed since the earthquake at New Madrid (1811-12). Before that event, Colonel Wiley had ploughed some of the land exactly over a spot now traversed by part of this water-course. I satisfied myself that the ravine had been considerably enlarged and lengthened a short time before my visit (1846), and it was then freshly undermined and undergoing constant waste."

After 1846 there must have been additional erosion, but probably more widening of the ravine and branching rather than deepening since its outlet is at St. Catherine's Creek whose bed is 60 to perhaps 80 feet below the 200-foot contour. The United States Geological Survey's topographic map (Natchez Quadrangle) of 1922 shows Mammoth Bayou to be somewhat more than 60 feet deep (below the 200-foot contour) in many places and from about 300 feet to more than 600 feet wide. Even superficial examination of the area of the ravine upstream from the bridge of the Pine Ridge road showed evidences of erosion in 1954, and the ravine throughout this area appeared to be more than 60 feet deep.

Professor Forshey, who was working with the geology and archaeology of the area at least as early as 1840 claims to have examined the "spot" where the pelvis bone was found, and that the bone was taken from a "dark loam in the bottom of the thirty-feet bayou" where it had fallen from a point above. This implies that the ravine was only 30 feet deep at the place and time of the discovery of the pelvis and at the time of Forshey's examination of the spot. Lyell who examined the area in 1846, presumably a few years after Forshey, said in substance that the bone was believed to have fallen from the 30 foot level to the bottom of the ravine. He also stated that there had been considerable erosion a short time before his visit and that it was still going on (1846).

From this evidence I would conclude that erosion had washed away the locus of the Natchez pelvis find, probably by 1846 and certainly by 1954. It thus appears futile to search for whatever was once attached to the Natchez pelvis. Such bones would have been redeposited in St. Catherine's Creek and eventually the Mississippi River.

It is possible, however, that other "early man" finds might be made in the Natchez area. Fossils have been found in the ravines and creek beds around Natchez for many years. Indians of the late prehistoric period probably picked up local fossils, because Dickeson found parts of Mastodon leg and foot bones in some of the mounds near Natchez (Culen 1900: 153-4). Forshey, probably in the 1840's, found numerous fossil remains near Natchez. He stated "The Mastodon bones and all others, of which there were many . . . were all rotten. We had the utmost difficulty in preserving any of them." (Foster 1878: 61). Lyell (1873: 238) implied a relative abundance of fossils when he stated that the "Mammoth Ravine" was so named "on account of the remains of the mammoth found in it."

Finds of fossil teeth and bones are still made occasionally along the eroded banks of St. Catherine's Creek and the various bayous, according to John L. Cotter who examined the area and questioned local residents during the 3-year period he worked on Natchez Trace archaeology (1954, personal communication). These fossil remains come from a bluish clay or gravel that underlies the thick deposits of loess and are characteristically found eroded into stream beds or the bottoms of ravines. The loess formations seem not to contain fossils other than the shells of land snails (Cotter 1954, personal communication).

Cotter's observations are completely in accord with what Getz and I found in our brief reconnaissance of the Natchez area. On the northeast edge of Natchez where Highway 61 crosses St. Catherine's Creek recent excavation for a bridge had produced a fresh cut at least 40 feet deep. This cut showed intermittent strata of bluish clay and gravel at the bottom and about 38 feet of buff loess on top. In the bed of St. Catherine's Creek at this cut we found a fragment of mineralized bone that appeared to be part of a long bone of some large animal and also a beer bottle cap. Both the fossil bone and the beer bottle cap had been redeposited from previous locations. Getz made a search of the bed of St. Catherine's Creek in the vicinity of the Fatherland Plantation site noting the same stratigraphy that we had seen at the bridge cut. We briefly examined Cemetery Bayou and Mammoth Bayou at the points where they cross the Pine Ridge road.

With the aid of binoculars we searched steep sides of the Devil's Punchbowl — a tremendous erosional phenomenon opening into the Mississippi River a few miles north of Natchez. At this point the loess seemed to have a vertical distribution of almost 200 feet.

North of the Devil's Punchbowl we followed a narrow dirt road from the top of the bluff down to the Mississippi River. Since this road cut across the face of the bluff we were able to examine the loess for a vertical distance of about 200 feet. In the loess there were many snail shells but nothing else.

In the vicinity of Bisland Bayou, north of Mammoth Bayou, we obtained useful information from an elderly gentleman who was a plantation owner, a doctor of medicine, and a life-long resident of the Natchez area. He informed us that he had found fossil bones in the blue clay and gravels and on the floor of ravines in the Bisland Bayou system. Only recently he had seen exposed the pelvis bones of some large animal. These bones had disintegrated during removal from the blue clay. He also recalled that some 70 years ago he had been able to jump across ditches flowing into Bisland Bayou and that these ditches were now ravines more than 100 feet across.

From all of these observations we concluded that the fossil remains in the vicinity of Natchez came from an undulating layer of bluish clay or gravel beneath the buff loess and that they are exposed or washed from one position to another in the course of erosion which can be quite rapid in this area.

It seems reasonably evident that at least one man (the original owner of the Natchez pelvis) was a contemporary of the mastodon, sloths, horse, and bison in the vicinity of Natchez.

The fossil-bearing stratum of blue clay and gravel is probably an eroded surface of the Montgomery terrace overlain by a thick deposit of loess.

The loess at Natchez is part of a narrow belt of loess 5 to 25 miles in width on the bluffs bordering the eastern edge of the alluvial valley of the Mississippi (Fisk 1944: 58).

There does not seem to be a geological concensus on the origin and age of the loess. Equally competent specialists are in radical disagreement (compare Russell 1944, Leighton and Willman 1950, Fisk 1951, and Simonson 1954).

The implications of the interpretation of Russell (1944) and Fisk (1951) are that the fossil bearing stratum is younger than the Montgomery terrace formation but older than the Prairie terrace formation — perhaps a period from somewhat before 18,000 B.C. to somewhat before 9000 B.C.

The implications of the interpretation of Leighton and Willman (1950) are that the fossil bearing stratum is not younger than the period of the last major glacial advance around 9000 B.C.

I would like to suggest the added possibility that the fossil bearing stratum dates from a period younger than the last major glacial advance but older than the altithermal — about 9000 B.C. to about 4000 B.C. This suggestion implies that the loess was deposited in the altithermal period. Probably none of the specialists cited would support such a proposition. I would discard the

hypothesis myself if early Archaic or paleo-Indian cultural materials were found on top of the loess. But even better would be some radiocarbon determinations of the time of deposition of the loess or the fossils beneath it.

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April, 1955

POSITION AND MEANING OF A RADIOCARBON SAMPLE FROM THE SHEGUIANDAH SITE, ONTARIO

An important radiocarbon date of 9130 ± 250 years (W-345) was recently received from Washington, courtesy of M. Rubin, United States Geological Survey. That it pertains to an archaeological site in an area commonly supposed to have been under Valders (Mankato) ice at that time is of significance in our studies of prehistory in Ontario. A few notes on the occurrence of the sample may be of interest.

The Sheguiandah site, in the northeast corner of Manitoulin Island, has produced strong indications that man was present before the last ice sheet advanced over the area. Unfortunately, no satisfactory charcoal sample was obtained from the older deposits in 4 years of excavating.

Four small swamps are perched within a few feet of the highest point of the quartzite hill on which the site occurs. Trenching revealed that artifacts, cores, and chippings are embedded in clays in the swamps, overlain by thick beds of peat. These clays are believed to be much more recent than the artifact-bearing deposits at another point on the hill.

A 5-foot section of peat overlies the clays of Swamp Number 3, providing a means of obtaining a *minimum* date for the artifacts in clays. In October of 1955 a sample of the basal 1-inch layer of peat was kindly accepted for testing by the U.S.G.S.

How may the results be applied? Obviously the artifacts here are older by an unknown amount of time. What has been dated? Ideally, the very beginnings of the peat accumulation are sought, but the necessity for obtaining quantities of material resulted in selection of an inch-thick section which in itself represents considerable time. It has certainly been subjected to maximum compaction and probably maximum disintegration, since the pollen analysis of J. Terasmae shows that the climate was already warm. The presence of spruce cones right to the bottom suggests that first accumulation was painfully slow. Further, vegetation may have been very slow in catching on this tiny knob of quartzite, scoured bare by the last ice.

Clearly, peat could not begin to form until the waters of Lake Algonquin had fallen to expose the hilltop. Nothing has been observed to suggest that the swamp was ever reinvaded by lake waters.

Pollen analysis shows that at one point on the peat profile, marked by a great change in the character of the peat, an intense cold period prevailed. The suggestion has been made that "this may correlate with the Cochrane glacial advance" to the north. If continued studies support this suggestion, further radiocarbon analysis may be carried out.

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FIG. 1. Copper plummet from the Poverty Point site, Louisiana. Length 1⅞ inches. James Durham collection.

A COPPER PLUMMET FROM POVERTY POINT, LOUISIANA

Upon examination of a series of artifacts found at the Poverty Point site, West Carroll Parish, Louisiana, in the collection of James Durham of Oklahoma City, Oklahoma, I noted one plummet made of native copper (Fig. 1). As copper objects are unreported for the Poverty Point site (Haag and Webb 1953), it is worthwhile to note the existence of this specimen.

The plummet is made of native copper, probably hammered into shape from a copper nugget. It measures 48 mm. in length, 20 mm. in diameter and is perforated for suspension. The plummet was picked up on the surface at the Poverty Point site by James Durham's brother, F. M. Durham, in 1944. According to F. M. Durham the specimen was found south of the large mound, in the area between the mound and the river.

HAAG, W. G. AND C. H. WEBB

1953 Microblades at Poverty Point Sites. *American Antiquity*, Vol. 18, No. 3, pp. 245-8. Salt Lake City.

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Norman, Okla.
January, 1955

STONE CROSSES WITH A CUICUILCO BURIAL

A recent article (Howard 1954) has described certain occurrences of cruciform artifacts in the Sierra Occidental from the Valley of Mexico to southern Arizona. The Valley of Mexico occurrence was reported in an earlier article (Haury 1945) which illustrates one of the objects (Fig. 2 *x*), and describes it as a "Cross (soft calcareous stone), Cuicuilco (Arizona State Museum collection, No. 13862)" (p. 61). I presume the specimen to be one found by Cummings during his excavations at the pyramid in 1924-25. The present article reports the discovery of 4 additional stone crosses at Cuicuilco in 1942.

At that time I was a student in the Escuela Nacional de Antropología, and during a visit to the Cuicuilco pyramid, I noticed human leg bones, about 2 feet below the surface, exposed by weathering of a wall of an old trench across the summit. I reported the find to authorities at the Museo Nacional, and assisted one of their representatives in the excavation of what proved to be a flexed burial accompanied by 4 small stone crosses (Fig. 1). The skeleton and artifacts were added to the collections of the Museo Nacional.

A description of the find may have been published in Mexico without my knowledge, but I doubt it, or Compton, Di Peso, Haury, Howard, Kelley, and Kelly, dealing with stone crosses in publications and letters dating from 1945 to 1954, would have mentioned it. Because of the current interest in stone crosses, the unanswered questions about their function and relationships, and their possible bearing on the problem of Mexican-Southwestern contacts, it seems advisable to present at this time what information I have about the additional examples from Cuicuilco, rather than to wait any longer for the more detailed account that may appear eventually.

After the wall of the trench was cleaned, the ends of the leg bones could be distinguished midway between 2 large stones resting on the grave floor. When the grave was cleared angular stone slabs were found in place around the bottom of the grave, which was broad, shallow, and basin shaped, 8 to 10 feet wide and about 3 feet deep. These dimensions may be somewhat inexact, since the contact between disturbed and undisturbed earth disappeared toward the upper, outer edges of the grave, no sign of which was visible at the surface. From the existence of a definite grave, and from its closeness to the weathered surface, I think it probable that the burial was intrusive.

Figure 1 was taken from the north rim of the excavation, looking down at the exposed skeleton and accompanying crosses. The body evidently was deposited face down on the floor of the grave, head to the south, with arms folded beneath the chest and legs drawn up to the left. The bones were in fair condition, as indicated by the photograph, but unfortunately I have no data on the sex, age, or other biological characteristics of the individual.

The 4 stone crosses may be seen lying flat, spaced at slightly different intervals and levels in a nearly straight row along the right side of the torso, from a point at the posterior end of the scapula to one near the posterior end of the pelvis.

FIG. 1. Burial at Cuicuilco with 4 stone crosses in place.

As I recall them, the crosses are made of a soft, porous rock, light in weight and color. Whether the material is calcareous (like that of the specimen found earlier at Cuicuilco), tufaceous, or otherwise, I do not know. In my recollection, the artifacts are crudely carved, possibly by removing 4 notches from a thick disc or square of stone and rounding off the edges of the resulting cross. If memory serves, they are about 1 inch thick and 2½ inches wide.

What significance these data may have for the problems of use, cultural affiliation, and temporal position of stone crosses in general, I gladly leave to the judgment of specialists in the fields of Mexican and Southwestern archaeology.

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March, 1955

A BURIAL CACHE FROM THE SPOKANE REGION

Burial practices are currently of considerable interest in terms of the developing patterns of Plateau culture sequences. Material documentation of prehistoric and historic burial procedure is now extensive though admittedly controversial in sequential interpretation. Suggestions as to covert behavioral responses accompanying the disposition of physical remains and attendant paraphernalia are much less satisfactory.

The authors recently had called to their attention a cache of aboriginal artifacts which suggested a funeral practice, perhaps widespread in the Plateau, but occurring supplementary to the archaeo-ethnically recognized forms of burial. This series of artifacts was situated in a shallow embayment near the top of a low cliff overlooking Hangman Creek, a confluent of the Spokane River, within the city limits of Spokane, Washington.

The cache, discovered by Ralph B. Ortel, the owner of the property, consisted of 3 associated segments: (1) the cairn, containing a pair of moccasins in its lowest portion and a number of beads in the interstices of its surface; (2) the near crevice, 8 to 9 feet above the cairn, containing a small buckskin bag with beaded fob attached; (3) the vertical crevice, 10 feet to the west, containing a beaded cover for the top of a toy cradleboard, a netted beadwork bag, and a buckskin doll.

A pair of moccasins, approximately a man's size 8, were found in the bottom of the cairn. The uppers are tanned buffalo skin; the soles cowhide, almost unworn. The moccasins are of the usual Plains hard-sole type, the uppers partially beaded in a design said to be characteristic of the Arapaho (Kroeber 1902: 39, Fig. 5 *b*). They have ankle flaps of doubled unbleached muslin. The beading and seams are sewn with sinew. The cowhide soles plus the beadwork design would suggest a date of no earlier than 1880 or later than 1920. Many seed and pony beads in various colors, both opaque and transparent, were scattered throughout the upper part of the cairn. The types and colors of these beads suggest dates between 1870 and 1920.

In the near crevice a small bag of soft buckskin 3 inches long with a fob of loom-woven beadwork attached at the bottom was recovered. The bag is sewn with doubled white cotton thread, as is the fob. Loom beadwork was probably introduced into the Plateau in late historic times.

The vertical crevice contained 4 items. A toy cradleboard cover which measures 4 inches high by 4½ inches wide was found. The style is that of the typical Plateau cradleboard. Black woolen cloth lined with print calico forms the base. Floral beadword covers parts of the front. The beadwork is sewn through both layers of cloth in overlaid stitch technique with doubled white cotton thread. The edges show that the cover was deliberately cut from the cradleboard. A piece of folded unbleached muslin and a folded piece of print calico were also found in this vertical crevice. Neither piece shows any sign of exposure to moisture or sunlight. From the shape the folded pieces assumed, it is probable that they padded the body of the doll kept in the toy cradleboard. It seems likely that the buckskin doll is the doll that belonged to the cradleboard. It is made of buckskin, loosely stuffed with various scrap materials. The facial features are indicated by faint pencil lines. The seams are sewn with white cotton thread. A small buckskin bag covered with bead netting was also found. The beads are seed beads in modern sizes and colors. The seams and the netting are sewn with white cotton thread.

This cache strongly suggests an analogous complex occurring in the vicinity of the Wishram Village Nixtlu'idix near the Dalles of the Columbia River. Strong, Schenk, and Steward (1930:121) reported the presence of a group of cradles wedged high in the cliffs to the north of the town. Subsequent data provided by R. B. Butler of the University of Washington correlates these Klikitat-type cradle boards with a low repository cairn situated upon a narrow ledge below. The cairn contained a bottle of antique pattern, disintegrated leather fragments, and other unidentified objects. A similar structure in the immediate vicinity contained related materials, and in addition, the fragments of a small china doll (dated about 1880). Wishram informants indicated that upon the death of an infant, his cradleboard and many of his possessions were placed upon a high cliff. The cradleboard was exposed to the elements and the other materials concealed in a low cairn situated as proximally as topography allowed. Informants suggest that the entire process serves as a cleansing, a means of removing the anguish of memory from the bereaved family. The data remain somewhat ambiguous, however.

The exposure is said to be oriented toward the morning sun, as if the low direct rays were most efficacious.

Although characterized by much better physical preservation, the materials from Spokane, in type and disposition, suggest the pattern of exposure as outlined above. No cradleboard was found. However, the area has been one of moderately dense population for a number of years, and hence it is probable that the board, if it existed, has long since vanished.

It thus seems a fair assumption that these 2 occurrences represent a practice existing concurrently and in definite association with recognized forms of burial. There is currently no real suggestion as to temporal depth. Terminally, the Wishram practice is quite recent, as several of the boards were plywood. The extremely decayed nature of others suggests a continuity of substantial age. The Spokane materials do not appear to be old, but are probably contemporaneous with the more recent Wishram occurrences. Similarly, there is no suggestion as to the temporal depth of the "emotional cleansing" concept as it has been interpreted at Nixtlu'-idix, nor can it definitely be attributed to the Spokane finds. None the less, this short statement is offered as a contribution towards the amplification of an important aspect of Plateau culture history.

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REVIEWS

EDITED BY RAYMOND H. THOMPSON

A Hundred Years of Archaeology. GLYN E. DANIEL. The Hundred Years Series, Gerald Duckworth, London, distributed by Macmillan, New York, 1950, reprinted 1952. 344 pp., 6 figs. $3.50.

Daniel clearly states in the preface that his book is not a history of all archaeology but only of influential discoveries and developments in prehistoric archaeology. Frankly selective, emphasizing the relation of the advance of this discipline to successive climates of thought, he provides a useful book indeed. Its well-documented themes are the ever-changing state of our knowledge and the effect of this flux on the growth of prehistory. Daniel has written for a British audience and heavily favors British and European illustrative material, usually ignoring New World counterparts. However, he has produced an admirable introduction to prehistory in general.

The work is fullest and most rewarding on early phases where Daniel sees prehistoric archaeology as the creation of Victorians, Europeans in a wider sense, with the period 1840-1900 as the creative one. His treatment is less well rounded on approaching the present, and is particularly sketchy regarding the Western Hemisphere. The Americas, India, and China are properly allotted the role of late outer echos, and only the beginnings of prehistoric studies are outlined for these areas. Eventually New World prehistorians should complete the record with accounts of the historic impact, for instance, of maize studies and of the work of Kidder and Shepard. These studies may not change fundamental archaeological philosophies but they do add range to methods and intensity to reconstructions.

The author chronicles the first and formative century from 1840 when studies began in earnest to 1940 when war halted work, and subsequent events are too close for proper perspective. He transgresses these limits only to summarize philosophic and antiquarian forerunners from Classical through Renaissance to earliest Victorian times and to annotate some Old World research to nearly 1950. A 19th century theme is the lag in general understanding of prehistory. Surprisingly early finds and theories were often disallowed by entrenched notions. Daniel shows how imaginative field workers eventually removed these doubts. A few minds prematurely established the conceptual channels for later rushes of popular acceptance. The realization of man's antiquity grew logically out of flaming controversies in Britain and France which surrounded artifact discoveries, biblical beliefs, geological concepts, and Darwin's popularization of evolution and mutability. Interest in the classic waned everywhere before local historic and prehistoric archaeology.

Meantime, the system of 3 ages was supported by stratigraphic evidence and the bases were laid for today's typological methods, descriptive classification, and taxonomy. Prehistory gained perspective through contacts with philology, human geography, and anthropology, and through the great fusion of Near Eastern and European archaeology into one fabric. With the increased scope made possible in the 20th century the rigid schemes of de Mortillet, Montelius, Müller, and Morgan fell. Exclusively evolutionary concepts deferred to those based on diffusion and differential stages of development; appreciation grew for time-lags in diffusion, for regression as well as progression, and for synchronological techniques to fix relatively dated regional cultures. Daniel details the changes from geological to historical and anthropological attitudes on prehistory which resulted in an emphasis on the description of cultures. He discusses the shift from the use of empty cultural terms in taxonomic systems to the recognition of significant associations of types in time and space as cultural assemblages. It is here that he graciously includes the New World with bows to Gladwin, McKern, and Taylor.

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Method in Prehistory. An Introduction to the Discipline of Prehistoric Archaeology with Special Reference to South African Conditions. A. J. H. GOODWIN. Handbook Series No. 1, 2nd ed., South African Archaeological Society, Capetown, 1953. 184 pp., frontis., 15 figs. 17s 6d.

The topics discussed in *Method in Prehistory* range in level from remarks on scientific method to tips on suitable packing materials for specimens. The book is directed at the serious student of archaeology, specifically at the members of the South African Archaeological Society, and its success is attested by the need for a second edition. Goodwin's discussions of several basic topics are vigorous and sensible; the reviewer was particularly impressed by his treatment of the amateur-professional relationship. On the other hand, the exposition of a number of other matters, both practical (especially surveying) and theoretical (especially cultural and chronological classification) is neither clear nor systematic.

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List of North American Recent Mammals. GERRIT S. MILLER, JR. AND REMINGTON KELLOGG. United States National Museum, Bulletin 205, Smithsonian Institution, Washington, 1955. xii + 954 pp. $3.50.

This revision of Miller's enormously useful work summarizes recent published opinion on the classification of New World mammals north of the Isthmus, including the Greater and Lesser Antilles. As is customary in such a list, there are no keys for identification. Recognized forms and their synonyms are merely listed with references to the original descriptions of all proposed names, whether valid or not. Additional references are also given where needed to clarify the present taxonomic status of a particular form; these include references to such generic revisions as have been made. Where possible, ranges are given in addition to type localities.

While most of this information is of concern to taxonomists, not archaeologists, the details of distribution and references to revisions of certain groups can be a real help to the lattter. Using both of these, the worker who wishes to study the mammals from a particular site can make a list of what might be expected to occur there. This will enable him to find out what comparative skeletons he should get and what creatures might be of particular importance to his work or to that of others.

Equally important to the archaeologist is the availability in one place of a standard set of names. While mammalogists are by no means in complete agreement on the classification of North American mammals, this work follows, as much as possible, published generic revisions. It is a good general summary of the opinions of specialists up to January 1, 1953, and as such, is recommended as a source of names for faunal lists. Comparisons of the occurrence of different species at several archaeological sites are far easier if a single set of names is used; otherwise it is hard to know whether the different names mean different forms or whether they mean that authorities disagreed about what to call the same animal.

Clearly, the treatment of different groups cannot be equal. Where a genus has been well studied, the trinomial status is such that useful identifications may be made to species only if desirable. For instance, a bobcat too fragmentary for subspecific identification may be listed as *Lynx rufus subsp.* and the worker on material from another site has a basis for comparison with his material. In a few instances, where a genus is in need of revision, it is more difficult to use this paper as a source of names. Under *Ursus*, for example, so many species are listed that it is impossible to name a grizzly or a brown bear. Such confusions are relatively few. For the most part, the archaeologist will find here a good, understandable set of names for such mammals as he may find in the course of his digging.

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Archeological Excavations in Mesa Verde National Park, Colorado, 1950. JAMES A. LANCASTER, JEAN M. PINKLEY, PHILIP F. VAN CLEAVE, AND DON WATSON. Archeological Research Series, No. 2, National Park Service, Washington, 1954. x + 118 pp., 72 pls., 9 tables. $1.00.

The joint authors of this attractive and copiously illustrated monograph have spent a combined total of some 50 years on Mesa Verde. The publication reflects their dedication to the study of southwestern archaeology, with emphasis on the cultural development within the boundaries of the National Park. Watson's "Introduction to Mesa Verde Archeology" is an excellent brief summary of Mesa Verde prehistory with notes on the naming, establishing, and early history of the National Park and a list of the major archaeological researches in the area. This convincing reconstruction of the cultural evolution of the Indian residents on Mesa Verde from the time of Christ through the 13th century, embellished with illustrations and with specific references deleted, would, by itself, satisfy the casual interest of most park visitors. In this respect it is unfortunate that Watson's recapitulation is bound with the more detailed, involved, and questioning-of-hypotheses studies of specific excavations.

"Excavation of Two Late Basketmaker III Pithouses" by Lancaster and Watson is a conventional report on a 2-pit house site. Until 1950 visitors to the Twin Trees area could see stabilized ruins dating from approximately 600, 840, and 950. A site dating about 700 which is admirably situated for display purposes was found, excavated, and stabilized to clarify the architectural development. Lancaster and Pinkley report on a multi-occupation site in "Excavation at Site 16 of Three Pueblo II Mesa Top Ruins." The excavators did a sterling job in determining the several superpositions, in delimiting the house structures of the different occupations, and in preserving the evidence in convincing form. The authors can take justifiable pride in their statement (p. 80): "Three Pueblo II Villages . . . , superimposed as they are, make Site 16 one of the finest comparative exhibits available in the field of Southwestern archeology. The 3 ruins demonstrate progressive architectural development, . . . the pottery proves this development took place within the limits of Pueblo II." "The Excavation of Sun Point Pueblo" by Lancaster and Van Cleave is a conventional report on a single-occupation, fortified, unit pueblo. In conjunction with the easily defended cliff dwellings this is a splendid display site eminently suited to provoke conjecture regarding the final exodus of the Pueblo Indians from Mesa Verde.

As the authors make many references to my work, a few comments on their remarks should be permissible. In the discussion of the possible time and reason for fortifications Lancaster and Van Cleave (pp. 105-6, 109) overlook dates of 1245 to 1266 for fortified sites in and near Hovenweep National Monument just northwest of Mesa Verde, and a date of 1225 for the earliest Mesa Verde occupation at Aztec National Monument to the

southwest (O'Bryan 1952, Abandonment of the Northern Pueblos in the 13th Century, Proc. 29th Inter. Cong. of Amer., Vol. 3, p. 156). Lancaster and Pinkley present strong evidence (p. 78) that my initial date of 1050 is too early for the McElmo phase on Mesa Verde. They may be right, and if so, I stand corrected. I continue to believe my dates are nearly correct for sites containing McElmo Black-on-white pottery, at least in the McElmo drainage some 40 miles northwest of Mesa Verde, because of the clustered treering dates of 1060 for a burned kiva containing several McElmo Black-on-white vessels (O'Bryan 1950, Excavations in Mesa Verde, Medallion Papers, No. 39, p. 109). It is certainly possible that Mancos Black-on-white potters lived contemporaneously on Mesa Verde, and that McElmo Black-on-white replaced the older ware gradually — perhaps from 1050 until later than 1074, the critical date at Site 16. Lancaster and Van Cleave belabor the same point unjustly and illogically (pp. 103, 105). The upping of an initial date amends, not "obviously impugns O'Bryan's revision of Gila Pueblo's McElmo Phase." Furthermore, the accusation that O'Bryan "has, too frequently, assumed that the dates deriving from a given site are representative of terminal dates for the site's occupation" is unwarranted. I refer the authors to Figure 5 (O'Bryan 1950:14), captioned "Selected Mesa Verde Ruins, Showing Occupation Span Suggested by Tree-Ring Dates," which shows initial as well as terminal dates and in which the word "suggested" is used advisedly. My awareness of the difficulties of precisely dating ruins by treering methods is shown in my note, "Methods of Felling Trees and Tree-Ring Dating" (1949, *American Antiquity*, Vol. 15, No. 2, pp. 155-6).

Despite these minor personal quibbles, I have nothing but the highest praise and sincerest congratulations for the authors of this publication. I consider it to be a splendid first of what I hope will be a lengthy series of studies by Lancaster, Pinkley, Van Cleave, and Watson.

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The Atlatl in North America. JAMES H. KELLAR. Prehistory Research Series, Vol. 3, No. 3, Indiana Historical Society, Indianapolis, 1955. Pp. 281-352, frontis., 23 figs.

This distributional study is based on both ethnological and archaeological sources. Kellar defines the atlatl as "a stick with provisions supplied on one end for grasping and a recurved pin or projection on the other to engage a nock or conical depression in the proximal end of a spear." He solves the difficult question of how to determine the presence of the atlatl in an archaeological context by using only "direct evidence," that is, the atlatl itself or a readily identifiable portion of it. He rejects the use of inferential evidence such as drilled problematicals or the size and weight of projectile points. He notes the possibility of variable function for bannerstones and other presumed atlatl weights and rightly states that while projectile point weight and size may preclude the bow, they do not identify the atlatl. The use of direct evidence prohibits any discussion of the probabilities of the presence of the spearthrower in such archaeological manifestations as the Northeastern Archaic or the Plains paleo-Indian.

Kellar concludes that the atlatl once had a widespread distribution over North America, that it was probably a part of a land hunting complex, and that it preceded the bow and arrow which subsequently replaced it in most instances. He does not think that the evidence warrants including the atlatl in the trait inventory of terminal Pleistocene migrants into the New World, as others have suggested.

Why did the atlatl survive to historic times in the Arctic and in Mexico and disappear in most of the intervening areas? Kellar wants to convince us that the usual explanation of the disappearance of the atlatl, which assumes an inherent functional superiority of the bow, is unwarranted. He argues that the atlatl persisted among the Eskimo because it is superior to the bow for hunting from a kayak: it frees one hand for maneuvering the boat in choppy water, it requires less space and is less cumbersome, and its usefulness is not impaired by moisture. He suggests that this aquatic association probably accounts for the survival of the spearthrower around Lakes Patzcuaro and Texcoco in Mexico. He thinks that the atlatl persisted among the Aztec because of its specialized military usage; he uses the concept of marginality to explain various isolated instances of atlatl survival. These examples lead him to the final conclusion that "the choice of weapons (bow vs. atlatl) was probably dependent upon differing patterns of life, and reflected, to some extent, environmental factors."

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Excavations at Cojumatlán, Michoacán, Mexico. ROBERT H. LISTER. University of New Mexico Publications in Anthropology, No. 5, University of New Mexico Press, Albuquerque, 1949. 106 pp., 36 figs., 4 pls. $1.50.

The Present Status of the Archaeology of Western Mexico: A Distributional Study. ROBERT H. LISTER. University of Colorado Studies, Series in Anthropology, No. 5, University of Colorado Press, Boulder, 1955. xi + 183 pp., 20 figs., 212 tables, 3 charts, 59 maps. $3.00.

Archaeologists have long realized that the solution to many of the problems of Mesoamerican archaeology and of cultural relations between the Southwest and Mesoamerica might be found in western (and northern) Mexico. In the 1930's considerable field work was carried out in this region and for the most part the results

of this work have now been published. Since World War II the tempo of field work has again speeded up. Among the most valuable and active of these new research programs is that of Robert H. Lister.

Excavations at Cojumatlán is one of the first of the important studies on the archaeology of northwestern Mexico which Lister has under way. It is a report of excavations made at Cojumatlán and adjacent sites southeast of Lake Chapala in 1941. The work was done by a party of students (including Lister) from the University of New Mexico under the direction of Donald D. Brand. Lister defines 2 periods of occupation. Resemblances between the red-on-brown ware which is characteristic of the earlier period and Mazapan Red-on-yellow, as well as the presence of slab moldmade figurines and 4 Plumbate sherds, led him to place the Chapala complex on the Mazapan horizon, about 1100-1300. In the subsequent Cojumatlán complex new elements including elaborate feather, feather headdress, and serpent motifs on the polychrome pottery together with animal and human effigy feet on the bowls suggest to Lister the appearance of Mixteca-Puebla influences and a post-1300 or -1350 date. The evidence certainly points to a Postclassic date for both complexes with Toltec or Tula-Mazapan affiliations for the Chapala and Mixteca-Puebla for the Cojumatlán. However, the apparent rarity of molcajetes and the lack of metals in the Chapala complex suggest that it may be rather early Tula-Mazapan. Therefore, Lister's dates for both complexes appear to be much too late in terms of currently accepted chronologies. Lister's placement of Cojumatlán in his more recent study (1955, Chart 2) suggests that he now shares this view.

In *The Present Status of the Archaeology of Western Mexico* Lister is, in essence, publishing his notes on the available literature, together with some personal observations, on the archaeology of this part of Mexico. The thoroughness of his preparation for work in the area is effectively demonstrated in this valuable and utilitarian handbook. In the initial sections of the report he covers briefly the general archaeological picture, the natural landscape, and the history of archaeological research in the region. He then lists 46 sites and areas representing the states of Sinaloa, Nayarit, Jalisco, Colima, Michoacan, Guerrero, Mexico, Guanajuato, Aguas Calientes, Zacatecas, and Durango. He omits the northwestern Mexican states of Chihuahua and Sonora which are usually considered archaeologically peripheral to the Southwest rather than Mesoamerica. He divides his "Western Mexico" into 11 "suggested archaeological provinces": Sinaloa-Coastal Jalisco, Nayarit-Jalisco-Colima, Durango-Zacatecas, Lake Chapala, Tzintzuntzan, Apatzingan, Chupicuaro, Upper Lerma, Middle Balsas, Costa Grande, and Yestla-Naranjo.

Lister discusses concisely the "significant culture elements of the archaeology of Western Mexico" under the categories: types of sites, pottery (vessel shapes, decoration), figurines, pipes, spindle whorls, miscellaneous clay items, stone objects, perishable items, shell objects, metal objects, disposal of the dead, and site features. In 56 maps and 212 tables he charts the distribution of the 212 elements in terms of their presence or absence in the sites and areas considered. There are 3 additional maps which show the region, the sites, and the suggested archaeological provinces. Sections on chronology (with 3 very helpful charts) and "Observations" complete the report. As a general survey this is a first rate production. It would have been greatly improved — as Lister notes — by the addition of a section on pottery design elements, but this would have involved doubling the size of the present paper. Archaeologists working in specific regions will be able to supplement and correct Lister's documentary survey with unpublished material. Thus, it would be possible to add many elements to his maps of Durango distributions from my own field work there. However, these shortcomings are inherent in any study such as this.

Lister's chronology is apparently based on Mexican and Maya cultural sequences which are dated by the Goodman-Martinez-Thompson correlation of the Maya and Christian calendars, inasmuch as he employs a dating of 900 to 1200 for the Toltec horizon. With the recent reinforcement of the Spinden correlation by radiocarbon dating, an alternate starting date for the Toltec horizon of around 600 to 700 must be considered. Such an initial date would much better fit the correlation between Southwestern and Mesoamerican cultural sequences which is now emerging from researches in northern Mexico; in fact, this earlier beginning date for the Toltec (Tula-Mazapan) horizon is now favored by some Mexican archaeologists on other grounds than the Spinden correlation. Accordingly, in using this handbook archaeologists should keep in mind the possibility that the dates employed may have to be revised in favor of earlier ones.

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Tula of the Toltecs. Bertha P. Dutton. El Palacio, Vol. 62, Nos. 7-8, Archaeological Society of New Mexico, Santa Fe, 1955. Pp. 195-251, frontis. (on cover), 1 fig., 20 pls., 1 chart, 2 maps. $.50.

For well over a decade, the site of Tula in Hidalgo, Mexico, has been generally regarded as the Toltec Tollan of traditional history. In spite of the burst of archaeological activity which helped to bring about the acceptance of this significant identification, a concise picture of the architectural and artistic findings at Tula has heretofore been unavailable for the English reader. Dutton has done this audience a service by bringing together data from scattered articles and illustrations, verbal reports, and her personal inspection of the site.

Except for a trait list of "Toltec Characteristics" and a brief section of "Appraisal and Implications," Dutton's approach is descriptive rather than analytical. However, detailed presentation, liberal illustration, and low price

make the publication a useful one. It is to be hoped that Dutton will soon publish a similar compilation of the materials she has gathered on the Toltec period at Chichén Itzá.

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Tlatilco and the Pre-Classic Cultures of the New World. Muriel Noé Porter. Viking Fund Publications in Anthropology, No. 19, Wenner-Gren Foundation for Anthropological Research, New York, 1953. 104 pp., 16 figs., 14 pls. $2.50.

On the outskirts of Mexico City, in a modern brickyard, is the extraordinary archaeological site of Tlatilco. Casually excavated specimens, which the brickmakers recovered from their clay diggings and sold, brought Tlatilco to the attention of archaeologists and collectors some years ago. In the 1940's systematic excavations were carried out by the Mexican Institute of Anthropology and History. Porter's monograph is based upon these explorations and upon the Covarrubias collection from the site which had been assembled in earlier years. It is not a detailed field account but a summary and appraisal of what has been found at Tlatilco and what these findings means in the larger setting of Middle American and New World archaeology. It is an important and timely work, and no monograph or article on Middle American sequence problems since the publication date of 1953 has omitted reference to the Tlatilco site.

Porter begins by sketching in the broad problem of inter-American relationships between the agricultural civilizations of native Mesoamerica and Peru. She observes that the most convincing case for long range diffusion in Nuclear America can be made on those chronological horizons that are generally characterized as Preclassic (Formative) in both Mexico-Guatemala and Peru. On these time levels, which are thought to be about contemporaneous, the evidence for historical connection centers in a group of ceramic features and motifs: rocker-stamped decoration, incision and excision, zoned or paneled decoration, jaguar representations, dual representations (half-human and half-jaguar or half-living and half-death head modelings of the same vessel), zoned red-painted decoration, clay stamps (both flat and cylindrical), and stirrup-mouthed jars. Unlike the "Q-Complex" of some 20 years ago, this clustering of traits does frequently appear, in toto, or in large part, as an actual complex in site-phase contexts. The situation can be summed up as Porter does in a concluding chapter (p. 79):

> Here we have the same ceramic features found grouped into a well-defined complex in both centers [Peru and Middle America] of Nuclear America and occurring on the same time horizon. The elements involved do not occur at random throughout the Pre-Classic period, but so far have only been found together. The very specific nature of these features, together with the fact that they occur as complexes in the same period, makes the conclusion almost inevitable that they must be historically related.

There is a brief discussion of the Tlatilco site which must suffice until a full field report is released. The important task here was the placement of the Tlatilco phase, as represented by specimens from some 200 graves plus the contents of several bottle-shaped refuse pits, into the Vaillant Preclassic sequence for the Valley of Mexico. Porter rejects the hypothesis that the Tlatilco assemblages are special grave wares or the products of an aristocracy who maintained a contemporaneous but separate existence alongside the Zacatenco peoples of the Valley. Judging from the facts so far reported, that is, the presence of Tlatilco style utilitarian wares which differ from those of Zacatenco and the absence of significant Zacatenco associations in Tlatilco graves, this seems to be a sound opinion. She argues, rather, that Tlatilco represents a distinct intrusion into, and a break with, the old Valley of Mexico Preclassic continuum. As such, Tlatilco falls somewhere between Vaillant's Lower (Copilco-Zacatenco) and Upper Preclassic (Cuicuilco-Ticoman) with a partial overlap with both. She substantiates this placement by pointing to the Tlatilco trait of abundant grave furniture, a Gualupita and Ticoman rather than a lower Preclassic mode, and to the similarity of much of the Tlatilco pottery and figurines to *late* Middle Zacatenco rather than to earlier styles. In such a position, Tlatilco assumes an importance as one of the main streams of influence conditioning the developments of the Upper Preclassic.

Porter follows the interpretation that the strong Olmec influences seen in Tlatilco figurines represent the beginning stages of the development of the Olmec art that was to flower in Classic times at La Venta in the east Mexican lowlands. This fits with Drucker's opinions on La Venta, but it is still a highly controversial matter. The chronological equation of Tlatilco with La Venta (and Lower-to-Middle Tres Zapotes) as a true horizon style remains a good alternative interpretation.

A chapter is devoted to an analytical description of the "significant" Tlatilco traits (those thought to have the greatest value as diffusion tracers), and this is followed by a comparative survey of the occurrences of these traits elsewhere in Middle America. In general, their appearance falls into the upper time ranges of the Preclassic although they are not, for the most part, on the Protoclassic level (Holmul I, and so on) but just prior to it. The fact that the Tlatilco traits are best represented as a complex in the eastern lowlands (Veracruz, the Ulua Valley) is noteworthy.

Farther afield, comparisons are made with Peru and, specifically, with the Chavín horizon complexes of the Peruvian coast such as Cupisnique. These are the dramatic resemblances alluded to above, and their presence appears to have been strengthened by the recent, and as yet unpublished, excavations of Reichel-Dolmatoff at Momil, near the mouth of the Sinú River in Colombia, and those of Evans and Meggers in the Guayas Valley of Ecuador.

Turning to eastern North America, Porter perhaps overemphasizes the difficulty in reconciling the dating of the Burial Mound cultures (Hopewellian and Adena-like) with those of the Mesoamerica upper Preclassic. If Tlatilco is placed somewhere between the radiocarbon dates for the earlier Zacatenco (about 1400 B.C.) and the later Cuicuilco (about 500 B.C.) phases of the Valley of Mexico — in the vicinity of 800 B.C. — the Hopewellian, and the more recently released Adena, dates may not be impossibly late. In looking to the north, Porter confines her attention to the Burial Mound cultures, largely, it appears, because of the presence of the rocker-stamped technique of pottery decoration. In so doing she tends to overlook, or underemphasize, the early "Caddoan" Temple Mound phases, such as Alto 1 of east Texas. These lack the rocker-stamped trait but show rather compelling Tlatilco similarities in such things as the tall-necked bottle form and the excision of hard, polished, dark wares.

Undoubtedly, the diffusions which she attempts to trace are multicentered and multidirected. For example, a tenable speculation for the present time might consider the Coast Chavín occurrences of the fairly full and tightly-knit Tlatilco assemblage as the diffusion of a complex, per se, perhaps from Mexico to Peru. On the other hand, the rocker-stamping technique may well have an earlier history in eastern North America than in either Mexico or Peru and may have filtered into the Mesoamerican Preclassic from the Mississippi Valley. Such an interpretation would explain the absence of most other Tlatilco features in the Hopewellian cultures. Somewhat later, the bottle form and other Mesoamerican traits which Krieger has seen in Alto 1 could have been diffusions in a reverse direction. Krieger's relatively early (A.D. 300-500) and much disputed dating of the temple mound-building Alto 1 phase tends to harmonize with this.

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The Water Lily in Maya Art: A Complex of Alleged Asiatic Origin. ROBERT L. RANDS. Bureau of American Ethnology Bulletin 151, Anthropological Papers, No. 34, Smithsonian Institution, Washington, 1953. Pp. 75-153, 6 figs., 6 tables.

Some Manifestations of Water in Mesoamerican Art. ROBERT L. RANDS. Bureau of American Ethnology Bulletin 157, Anthropological Papers, No. 48, Smithsonian Institution, Washington, 1955. Pp. 265-393, 10 figs., 5 pls., 6 tables.

In the first of these papers, Rands makes a thorough survey of floral forms in Maya art and more specifically of the water lily, to see whether their variety, distribution, and associations accord with the hypothesis of an Asiatic origin for certain motifs involving the water lily or lotus. His results are largely negative. He finds that representations of the plant are intimately associated with basic Maya symbols, if not throughout, certainly during most of the Classic period, and that the most striking resemblances to forms in peninsula India which are cited in support of the theory, occur late in the Maya development and in designs entirely consistent with the Maya tradition. Nevertheless, Rands admits that the "truly remarkable parallels" between Maya and Asiatic representations require an explanation and suggests a number of considerations that may be relevant.

The paper is on the whole well-conceived and represents an impartial and thorough investigation of the problem, but the presentation lacks an organization that would make it effective. The approach resembles dissection rather than analysis. Rands distinguishes 13 elements of treatment of the water lily leaf, 18 types of Maya treatment of the flower, 22 elements of the Maya treatment of the water lily flower, 6 types of treatment of the stem as a panel, and 12 over-all types of presentation. These, as well as symbolic associations, are charted in a formidable series of tables at the end of the article. The distributions, at least as presented, throw little if any light on the significance of all these variations, and the charts seem designed for no other purpose than reference to where these items occur. Perhaps all these raw data were included to permit the reader to check the argument for himself, but he can do so only by repeating the whole laborious process of research. The relevant and important factors could and should have been abstracted, organized, and presented so that this would not be necessary.

The second paper makes even heavier reading. In this, Rands reviews the known forms of water symbols, confirms the identification of some that were doubtful, and points out several that had not been identified before. It is difficult either to judge how much of this is new or to weigh its validity. The length of the paper (122 pages) is clearly out of proportion to the requirements of the subject and can be justified only if we regard it as a general thesis on the rationale of symbol identification. For all its references to methodology, however, it offers no short cuts to good judgment — no new, practical, or effective approaches. The moral fervor of the scientist's conscience rather than the ingenuity of the inventor is at the bottom of Rands's "methodology." Among 9 "methodological constructs," three refer to the "willingness" of the investigator to use certain approaches, that is, the "willingness to see the artistic creations as a functional whole." A fourth construct begins with "maintaining an awareness," and another involves "differentiating rigorously." Sincere endeavor and a clear scientific conscience are certainly not to be despised, but "methodological constructs" are a poor substitute for methods, and Rands's argument is overwhelming rather than convincing.

In fact, his argument merely serves to show that he has worked with scrupulous attention to detail and with an earnest endeavor to eliminate all insights for which he could find no rational basis. The wisdom of such elimination is debatable, but the folly of publishing without condensation not only all the compilation of

data, but even all the considerations that enter into the judgment of the meaning of each representation, is more obvious. Rands' propositions can be demonstrated only by showing that the forms and associations of water symbols are distinct from those of other symbols and that together they form a consistent structure; but the treatment of a significant number of symbols in the manner the author proposes clearly exceeds the practical limits of research.

It is imperative that we seek general principles and abstractions to enable us to organize such data into manageable form and to test conclusions in some simple and decisive way. Rands's "methodology" fails to bring us even a step nearer this goal, and only emphasizes its remoteness.

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The Pre-Columbian Cultivated Plants of Mexico. ROBERT L. DRESSLER. Botanical Museum Leaflets, Vol. 16, No. 6, Harvard University, Cambridge, 1953. Pp. 115-73, 1 pl. $0.65.

Dressler has compiled an exceedingly useful summary of the botanical literature on the agricultural plants of ancient Mexico with special reference to geographic origin and distribution. A long bibliography is carefully keyed into concise discussions arranged alphabetically by species. Dressler lists 88 species: 71 indigenous to the Mexican-Central American region, 6 of Andean origin, 3 from Lowland South America (Brazil-Paraguay), and 8 unknown. Anyone interested in the agricultural basis of the prehistoric cultures of Mexico and North America particularly and the New World generally will find this compilation a most convenient starting point in any search for information on the cultivated plants.

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Irrigation Civilizations: A Comparative Study. A Symposium on Method and Result in Cross-Cultural Regularities. Spanish ed.: *Las Civilizaciones Antiquas del Viejo Mundo y de América.* JULIAN H. STEWARD, ROBERT M. ADAMS, DONALD COLLIER, ANGEL PALERM, KARL A. WITTFOGEL, RALPH L. BEALS. Social Science Monographs 1, Social Science Section, Department of Cultural Affairs, Pan American Union, Washington, 1955. v + 78 pp., 6 figs. $0.50.

This monograph is an outgrowth of a symposium on cultural evolution held in 1953 under the chairmanship of Julian Steward at the annual meeting of the American Anthropological Association in Tucson. The purpose of the symposium was to test Steward's hypothesis that early irrigation civilizations in Mesoamerica, Peru, China, and the Near East "had developed through similar periods for fundamentally the same reasons." Steward defines the problem in an introduction; Adams, Collier, Palerm, and Wittfogel write on aspects of irrigation civilizations on Mesopotamia, Peru, Mesoamerica, and China, respectively. Beals contributes an excellent criticism, evaluation, and review of the preceding papers. In the final paper Steward attempts to summarize the findings of the symposium and to modify his original hypothesis in line with them.

The papers on the 4 areas under discussion are interesting and useful summaries of the archaeological developments in each area with irrigation as the focal point. For the most part old data are presented in a new frame of reference. Wittfogel, however, has drawn on much of his own unpublished material, and Palerm cites unpublished work by William Sanders which promises to be a significant contribution once it is available. The theoretical results are inconclusive in that the symposium members were unable to establish whether the irrigation, or hydraulic, societies in the 4 major areas had followed the same lines of development and had been affected by the same causative factors. Lack of evidence for early extensive irrigation in Mesoamerica, however, suggests that the development there at least may have followed a different line than it did in the other 3 areas. There still seem to be only 2 factors which are common to societies with large-scale irrigation: dense population and some form of social control to insure the requisite labor and to regulate the distribution of the water.

The diverse nature of the papers and the uneveness of the basic data available from the different areas seem to be the primary causes of these inconclusive results. Much more field work and analysis are needed in all 4 areas before it can be determined whether there is a "common configuration of development" stemming from the same initial causes in all cases. Beals points out that there must be a more precise terminology for types of settlement patterns differing in size and function before comparisons can be satisfactorily made. There is also a need for agreed-upon criteria for such archaeological categories as "intensive farming," "great temples," "organized warfare," "full-time specialists," and "class stratification." Finally, Beals states (p. 56):

> The inventories in the papers deal very largely with specific content items. If I understand the multi-lineal evolutionary approach implicit in the organization of the symposium, comparisons must be based not on specific content, but upon abstracted, qualitative differences between various levels of organization and integration, and perhaps upon recurring sequential processes. It is much harder to develop valid abstractions than it is to make inventory lists, but I think the symposium clearly points to the necessity of much more abstraction and theoretical development if the search for regularities in culture is to be successful.

Even though the symposium failed to satisfactorily test Steward's hypothesis of multilineal evolution, it has shown the direction which research must take in order to deal with such problems. The Social Science Section of the Department of Cultural Affairs of the

Pan American Union has very effectively put this research program in motion by making the results of the symposium available in both Spanish and English as the initial number of its Social Science Monographs.

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Highway of the Sun. Victor W. Von Hagen. Duell, Sloan and Pearce, New York — Little, Brown, Boston, 1955. 320 pp., 32 pls. 4 maps. $6.00.

Anyone who read the *New York Times* from 1953 to early 1955 must have been aware that Mr. Von Hagen's Expedition, emphatically with a capital E, was progressing triumphantly from one end of Peru to the other by truck, mule, on foot and by air. It was the most publicized Expedition that the reviewer can recall, and if the results had been more spectacular it would undoubtedly have outstripped Egypt's Solar Boat in photographic coverage.

The Expedition, sponsored by the American Geographical Society, set forth to learn as much as possible about the Inca road system, and did, in fact, add a lot to our knowledge of it, especially in connection with the lateral roads joining the coastal and highland trunk routes. It also made possible some good, controlled archaeological excavation by Francis Riddell and his wife, Dorothy Menzel, at Acari and Chala, on the south coast. The publication of their work will add an important contribution to the growing, but still scanty, list of reports from the coast south of Lima, and may well be the most useful result of the Expedition.

Von Hagen's book will be of little help to the archaeologist who wants to find out what the Inca road system was like, except in the most general terms. It was written for the public and never allows the reader to forget the hardships, thrills, dangers, and difficulties of Exploration (again with a big E). The road system is, of course, traced, but so unsystematically that one has to check constantly to find out precisely where he is, since there is very little relation between text and maps.

As an adventure story it is amazingly exaggerated, and to one who knows anything about highland archaeology, a lot of it is ridiculous. For example, of a *chullpa* site not far from Puno where this reviewer and Harry and Marion Tschopik used to picnic and record the burial towers on Sundays, Von Hagen opens a chapter by saying "We were lost in a veritable forest of *chullpas*, the stone Towers of the Dead." Then, in spite of the fact that he lists Marion Tschopik's paper on Puno sites in the bibliography, he states that "these tombs had been sacked first by the Incas and later by the Spaniards, and so thoroughly that just who built the Houses of the Dead has never been discovered." This typifies the tone of specious, romantic mystery with which the author surrounds perfectly well-known sites. Obviously the book was written to sell, and it is unfortunate that in order to do so it was so over-sensationalized.

It seems to the reviewer that there is enough intrinsic interest in the area to have made possible a clear, connected account of the work, of the kind that the author through his interest in Stephens and Squier, knows so well.

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Investigaciones Arqueológicas en la Sabana de Bogotá, Colombia (Cultura Chibcha). Emil W. Haury and Julio César Cubillos. University of Arizona Bulletin, Vol. 24, No. 2, Social Science Bulletin No. 22, University of Arizona Press, Tucson, 1953. 104 pp., 32 figs., 7 pls. $1.00.

This is a report of 6 months of field work in highland Colombia in the territory occupied by the famous Chibcha tribe at the time of Spanish conquest. Haury and Cubillos worked principally in the savannas of Bogotá, Fuquene, and Sogamosa. These are large elevated Pleistocene lake beds that are now filled with sediment and form fertile plains. This is exactly the sort of terrain that one might suppose would best support an agricultural economy. The authors made a careful examination of the wide floors of these valleys but found scant evidence of either dwelling sites or agricultural evidence dating from pre-Spanish times. However, house sites and agricultural terraces are scattered along the lower slopes of the mountains that border the flat terrain. The terraces are not stone walled as in Peru and have not previously been reported from the northern Andes.

No evidence was found of what might be classed as urban centers. The population appeared to have been sparse; certainly there is not enough occupation evidence to support the estimate sometimes made of a million Chibcha Indians. At a few localities houses had been grouped to form villages; 3 of these, at Facatativá, Pueblo Viejo, and Guachancipá, were excavated. None showed refuse deposits of over 1 m., they were not stratified, and cultural remains were scanty. A total of 4000 sherds was collected. This evidence allowed the establishment of a short chronology: Recent, from the present to 1820; Colonial, 1820 to 1537; and Preconquest, pre-1537. Aside from the scant pottery remains very few other cultural features were recovered. These included burials, grinding stones, and a few chipped stone tools.

Haury and Cubillos cast considerable doubt on the commonly accepted idea that the Chibcha had the third most highly developed culture in the New World. They cite not only the lack of evidence for sufficient population to support a complicated cultural structure but the absence of cities, virtually an inevitable prerequisite for high cultural development. They intimate that the chronicles of the Chibcha conquest may represent an early example of yellow journalism and should be re-examined.

I have a certain sympathy for the authors of this careful study with its somewhat negative results, for it parallels a year of survey I made in the Cauca Valley and the bordering mountains. It is possible that the entire central part of Colombia was occupied for a relatively short time before the Conquest by an essentially rural population. Haury and Cubillos think that the Chibcha failed to utilize the tempting appearing savannas for agriculture because of their inability to dispose of surplus water. Bennett and I concluded that the similar failure to take advantage of the broad flat Cauca Valley may have been due to lack of tools and techniques to farm grasslands.

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Peruvian Domestic Fabrics from Supe. A Study of the Uhle Collection of Painted Cloths. Ina VanStan. Notes in Anthropology, Vol. 1, No. 3, Department of Anthropology and Archaeology, Florida State University, Tallahassee, 1955. 56 pp., 1 fig., 3 pls., 12 tables.

VanStan has made a careful analysis of some 147 plain-weave cotton fabrics from Supe which served as foundations for hand painting. The textiles, which were excavated by Max Uhle at San Nicolas, are believed to date from the Middle Period. The homogeneity of the painting, considered by Uhle to have been the work of professionals, is in contrast to the weaving, which VanStan concludes was done by the relatives of the deceased. There is some evidence that the Supe textiles were stiffened by sizing. The varied textures of the cloths and the looseness and the fuzziness of many of the yarns suggest that sizing would be necessary in order to hold the paint. In addition to these cloths there is a small collection of painted cloth objects such as bags and grave tablets. The sizes of these indicate that they were woven in specific size and proportion for the final purpose. VanStan summarizes her findings in scatter diagrams and tables. This study of the weave textures will serve as a companion to the forthcoming analysis of the paintings which was begun by Lila M. O'Neale and is being completed by Anna H. Gayton.

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The Archeological and Paleontological Salvage Program in the Missouri Basin, 1950-51. Paul L. Cooper. Smithsonian Miscellaneous Collections, Vol. 126, No. 2, Smithsonian Institution Pub. 4188, Washington, 1955. iv + 99 pp., 12 pls., 1 map. $1.35.

Cooper served as field director of the Missouri Basin Project of the Smithsonian Institution's River Basin Surveys in 1950-51. He presents in this report a concise summary of the work. These 2 years were busy ones in the Missouri Basin; increased Federal funds made possible 16 field parties. Also, at this time the National Park Service began the allocation of federal funds to state agencies for the excavation of sites threatened by the federal water-control projects. Agencies in Montana, Wyoming, North Dakota, South Dakota, Nebraska, and Kansas participated in this program. This activity resulted in the excavation of 66 sites in 11 reservoir areas.

The greater part of the report is devoted to descriptions of sites and materials from the Tiber Reservoir in Montana, the Garrison Reservoir in North Dakota, and Fort Randall and Oahe Reservoirs in South Dakota. The excavated sites cover a time range from altithermal times to the last half of the last century and include even historic White sites like Fort Stevenson in North Dakota. These reveal the great complexity of the archaeology of the region and point up problems which should keep Plains archaeologists busy for years to come.

The concluding statement indicates the difficulty of attempting to digest materials without allowing proper time for chewing. This is, of course, not Cooper's fault for he emphasizes that this paper is only a progress report on field work accomplished. As such, it is a valuable contribution to the River Basin program and a necessary item for anyone attempting to keep up with the general progress of the rapidly developing archaeological picture in the northern and central Plains.

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Prehistory of the Upper Ohio Valley: An Introductory Archeological Study. William J. Mayer-Oakes. Annals of the Carnegie Museum, Vol. 34, Anthropological Series, No. 2, Upper Ohio Valley Archeological Survey, Contribution 20, Carnegie Museum, Pittsburgh, 1955. ii + 296 pp., 30 figs., 120 pls., 7 tables, 30 maps. $4.00 paper, $5.00 cloth (plus shipping charges $0.25, foreign $0.35).

Mayer-Oakes has made a notable contribution to the archaeology of the Northeast. This report marks a turning point in a long-term program. It is intended both as a statement of a completed survey project and as groundwork for a series of future specific research projects. He succeeds admirably in both objectives. The material is ordered in a chronological framework, with an introductory general outline, fuller discussion of a sequence for each of 4 subareas, an interpretative summary, and a statement of future research problems. Some of the devices which he uses are annoying, such as a seriation chart of recent lamp types, a few plates of notebook forms, over-scaled county maps, and plates of specimens that are mostly blank space. But the illustrations are usually excellent; in many cases, artifacts represented in synoptic drawings appear elsewhere in photographs. The text is tightly written with just enough reiteration and cross reference to aid the reader.

Since the Upper Ohio region lies at the edge of a culture area and is one of the eastern borders of the Interior Basin, relationships with neighboring regions and cultural parallels are exceptionally important. Mayer-Oakes deals with these on the grand scale, reaching expertly into the literature and collections of other areas for comparative material. The net effect is a good sense of the place which each of his units held in the larger geographic picture; his view of Upper Ohio archaeology is scarcely a provincial one. However, notice of Virginia archaeology, particularly recent research in the Great Valley, is surprisingly absent, especially since closely related complexes of that area now go under markedly different labels. A notched pentagonal projectile point form, Racoon Notched, is described, but its analogues in Intrusive Mound, Point Peninsula, and certain eastern Pennsylvania and southern New England complexes are not mentioned.

The paleo-Indian evidence is based on a survey of fluted points, and notes on a few scraper forms, but does not yet include site association. Lanceolate points of the "Ohio Yuma" varieties are interpreted as late paleo-Indian remains with Archaic linkages. In this, as in many other phases, Mayer-Oakes sees the region as an extension of the prairie areas to the west and not of the Atlantic slope. A number of distinct Archaic complexes are outlined. I am especially pleased with his emphasis on the great chronological and areal differences which are to be seen in the Archaic, and his suggestion that still greater cultural variations are to be expected. The material from the "Ceramic Epoch" is closely related to the Adena-Hopewell and Fort Ancient components of surrounding regions. Mayer-Oakes provides the first adequate discussion of the early historic phases of Fort Ancient, but gives too little attention to the Madisonville site itself. I think that his date of pre-1650 for these components is too late; I judge from the trade goods that they are pre-1620.

This excellent report is not the product of a highly endowed museum project, but is the result of a modestly financed program characterized by good planning and administration. Both Mayer-Oakes and the Carnegie Museum are to be congratulated.

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River Basin Surveys Papers, Numbers 1-6. Bureau of American Ethnology, Bulletin 154, Inter-Agency Archeological Salvage Program, Smithsonian Institution, Washington, 1953. xv + 336 pp., 40 figs., 56 pls. $1.75.

The 6 papers in this bulletin initiate the *River Basin Surveys Papers*, a new series designed as an outlet for reports resulting from the Inter-Agency Archeological Salvage Program. This initial effort is quite praiseworthy in general organization and content.

"Prehistory and the Missouri Valley Development Program. Summary Report on the Missouri River Basin Archeological Survey in 1948" by Waldo R. Wedel is the third in a series of annual summaries begun in 1946. During the 2½ year period which this report covers 194 new archaeological sites were recorded. Detailed reports are given for a few sites where excavations were conducted with "mechanical aids" which permitted the stripping of the sod and soil cover "so that the complete village layout could be determined and mapped." Further work was done on 2 early sites in the Medicine Creek Reservoir in Nebraska which "have been assigned by University of Nebraska paleontologists to the basal positions of the Republican River Terrace 2 which is provisionally equated with the beginning of Mankato substage of the Wisconsin Glaciation." However, Wedel is reserved in accepting these extreme estimates of age which would give us 2 sites earlier than Eden Valley Yuma and Lindenmeier Folsom. Other excavations strengthen the Woodland picture; the Keith focus appears to be taking shape in southern Nebraska and western Kansas. Later Upper Republican sites, protohistoric Great Bend aspect material, and some possible 17th century Wichita remains permit Wedel to epitomize the whole of Plains prehistory in some believable concluding paragraphs.

The second paper is Wedel's "Summary Report on the Missouri Basin Archeological Survey in 1949." Because of a greatly reduced budget and several critical personnel changes in 1949, archaeological field work was curtailed. "Projectile points of unquestionable Plain View type" were found in "an occupational horizon" at one of the Lime Creek sites. This find does little to substantiate the "pre-Mankato climax" date which had been assigned to these sites the year before. The plates in these 2 summaries reveal little archaeological information but they do illustrate some interesting archaeological techniques.

Marvin F. Kivett records the secondary burial of more than 60 individuals at a basically Woodland site in the third paper, "The Woodruff Ossuary, a Prehistoric Burial Site in Phillips County, Kansas." Charred segments of logs, burned earth, and shell disc beads "in all stages of manufacture" characterize the deposit. The pottery is thick, cord-roughened, and calcite tempered; Kivett assigns it to the Keith focus.

"An Archeological Survey of the Addicks Dam Basin, Southeast Texas" by Joe Ben Wheat is one of the first reports of intensive archaeological investigation in the Galveston Bay area. No less than 12 previously described types of projectile points are recognized, plus 32 "provisional" types. Wheat classified the nearly 5000 sherds as a "single, highly variable ware" which he divided into 2 subtypes on the basis of decoration. Swanton derived the pottery of this area from trade with the "Avoyels" Indians, but since nothing is known of their pottery an ethnohistorical correlation with the makers of the Adicks Basin pottery is precluded. Although this is an important report for the Galveston Bay area and

a basic reference for attempts to extend southeastern cultural connections in the Texas Gulf Coast, many of its conclusions must be accepted with some reserve.

Marshall T. Newman contributes a brief paper on "Indian Skeletal Remains from the Doering and Kob Sites, Addicks Reservoir, Texas." He finds both early longheads and protohistoric roundheads represented in the 7 burials, but refrains from firmly identifying the latter with the Atacapa and Karankawa.

Herbert W. Dick describes salvage operations in "The Hodges Site: Two Rock Shelters Near Tucumcari, New Mexico." He concludes that the site was occupied from the late 14th or early 15th century to the mid-16th century "by a group (or culturally related groups) of simple hunting-gathering people."

Sheldon Judson's "Geology of the Hodges Site, Quay County, New Mexico" is a well contrived and well written account of the mutually beneficial results obtainable when a datable archaeological horizon can be definitely related to a geological event. This concise article demonstrates how rewarding a clear understanding of local geology can be to the archaeologist.

Joseph R. Caldwell reports some test excavations at a mound group on the Savannah River near Augusta in the final paper, "The Rembert Mounds, Elbert County, Georgia." The pottery is almost all of Lamar types; the site is thus judged to have been occupied between 1450 and 1650.

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An Archaeological Report on the Excavation of a Prehistoric Site at Zuma Creek, Los Angeles County, California. STUART L. PECK. Archaeological Survey Association of Southern California, Paper No. 2, Los Angeles, 1955. xiv + 87 pp., 22 pls., 1 chart, 2 maps. $2.50.

The Zuma Creek report, the first full-length monograph published by the Archaeological Survey Association of Southern California, is a more than welcome addition to the all too scanty literature of an area where publication has lagged far behind excavation. However, it is unfortunate that the many misspellings and typographical errors were not eliminated.

The Zuma Site is on Point Dume, 18 miles up the coast from Santa Monica. Volunteer workers, digging during week-ends for nearly a year, obtained more than 600 artifacts which exhibit minimal change, with types much the same from beginning to end of occupation. Manos and metates are particularly abundant; coarsely chipped core and flake tools are also well represented. The "Teshoa flakes," plano-convex flakes made from fine-grained cobbles, receive special attention; they seem to be emphasized beyond their importance as many appear to be merely chips broken away from stones used for pounding or subjected to heating.

The Zuma people are judged on evidence of grinding implements to have been primarily seed-gatherers. Actual food remains consisted of marine shells and an exceedingly small quantity of mammal, bird, and fish bone. The 6 burials include flexed and extended interments and reburial. This diversity is attributed to occupation by people with different cultures, but since similar variations occurs at nearby sites there may have been a period during which several methods of burial were practiced simultaneously.

The problem of antiquity receives little attention, aside from a statement that the locality was occupied "possibly five, eight or more thousands of years ago." Although evidence for this dating is not given, several facts which point to an early placement are mentioned: soil induration, simplicity of cultural remains, and an absence of items diagnostic of later occupations. Affiliations with ancient coastal assemblages (Oak Grove, Topanga, and Malaga Cove) are convincingly demonstrated. The Zuma materials fit into a simple, uniform pattern of life established early along the southern California coast.

All in all, this is a thoughtful report. The artifacts are adequately described, but dimensions and numbers are not always given in the text; the classification of manos seems unduly complicated. Although there is a paucity of published material, Peck did not utiltize some of the available comparative data. Interpretations are occasionally shaky. For example, Peck states that "reburials suggest the *mourning ceremony* of the Gabrieleno and other southern California tribes" despite the fact that this ritual involved burning images of the dead and property, not digging up and replacing skeletons. There has been a tendency among some local archaeologists to attribute all manner of practices to "mourning ceremonies."

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NOTES AND NEWS

EDITED BY CLEMENT W. MEIGHAN

GENERAL

The following note is of general interest since it outlines the successful prosecution of an Antiquities Act violation. Although vandalism cannot be legislated out of existence, knowledge of this case may serve as a deterrent to some relic collectors who believe that the law is never enforced.

On April 30, 1953, as Consulting Archeologist for the Department of the Interior, Jesse L. Nusbaum filed with the Office of the Secretary his most conclusive Antiquities Act violation charges since 1927. He recommended criminal prosecution of John H. Brandt, then a student at Adams State College, Alamosa, Colorado, who had twice been warned of the consequences, for excavating, vandalizing, and removing artifacts, with the aid of 2 other students, from the largest Promontory Cave cliff dwelling in the remote Segi Ochong Canyon wilderness of the northern Navajo Reservation.

The Area Director then administering the Navajo Reservation was instructed to promptly conduct the field investigation and take such legal action as findings supported. When Nusbaum protested his findings and recommendation of no criminal prosecution, only possible censure, instructions were received to submit documentary files on this controversial issue to the U.S. Attorney for the District of Arizona, for his review and decision. He in turn issued the direct criminal information U.S.A. versus John Henry Brandt, No. C-3758 Pct., for violation of the Antiquities Act.

On September 26, 1955, following final futile appeals to the Secretary of the Interior and General Superintendent Spaulding of the Central Navajo Agency to quash Nusbaum's violation charges and criminal proceedings, defendant John Henry Brandt appeared before the U.S. District Court at Phoenix, with his counsel, and entered a plea of guilty to the charges pending against him. The court thereupon fined him $100.00 and restored the confiscated artifacts to the Navajo Tribal Council. This Antiquities Act conviction is the first achieved in Arizona.

HIGHWAY SALVAGE ARCHAEOLOGY

On March 30, 1956, the Bureau of Public Roads issued a policy and procedure memorandum (No. 20-7) pertaining to the salvage of archaeological materials threatened with destruction by highway construction. This memorandum is of major importance to all archaeologists as it provides for the use of Federal funds to pay the cost of salvaging such archaeological materials on both Federal and Federal-aid highway construction. On Federal projects, that is those highways built by the Bureau of Public Roads for other Federal agencies such as the Park Service, the Forest Service, or the Atomic Energy Commission, the Bureau of Public Roads will pay the full cost (archaeological supervision, labor, and equipment) of the necessary salvage excavations, although they will not cover the cost of looking for such ruins, shipping of archaeological material from the site, or publication. On Federal-aid projects the Bureau of Public Roads, at the request of the local State Highway Department, will pay a percentage of the cost of such archaeological salvage. This percentage is 50% in most states, but is slightly higher in the "Public lands states" in the west. In the Highway Act now pending before Congress, the Federal portion for the "Interstate System" is 90%, plus additional increments in the "Public lands states."

Because of Memorandum 20-7 it is now possible for all states to initiate systematic programs of highway salvage archaeology. In every state a vast amount of our archaeological resources are now being destroyed by highway construction. This loss can be prevented if the archaeological institutions in each state will contact their State Highway Departments and invite their attention to this memorandum, acquaint them with the need for archaeological salvage, and, finally, indicate their willingness to cooperate in the salvage excavations. The most important item of cost for the archaeological institution will be paying for the search for archaeological material in the construction areas, but these costs are small when viewed against the information recovered and the financial contributions of the construction agencies. To assist in developing such programs the Society for American Archaeology has appointed a committee consisting of L. S. Cressman (Northwestern States, Alaska, and Hawaii), Clifford Evans (Washington, D.C., area), W. J. Keller (Bureau of Public Roads), John Mc.Gregor (Central States), Irving Rouse (Northeastern States), William Sears (Southeastern States and Puerto Rico), and Fred Wendorf (Southwestern States; Chairman). The President and Secretary of the Society are ex officio members. Individuals and institutions interested in further information should contact the committee member in their area.

ARCTIC

POINT BARROW. As Director of the Human Factors Project in the Bio-Mechanics Laboratory at Tufts University, Wilbert K. Carter is now concentrating on research in design engineering and physical anthropology under the sponsorship of the Air Force. He is continuing, however, to work on his Point Barrow collections at Harvard and plans to begin publication of this material with several papers. The first of these will probably be an expanded version of "Iron Traded to Alaskan Eskimos Prior to 1000 A.D.," which he read at the November, 1955, AAA meetings.

ASIA. The Council for Old World Archaeology, Inc. will launch its publication program with an issue on Soviet Asia. This is scheduled to go to press this sum-

mer, and it will consist of a sumary of recent field work in Soviet Asia together with a selected, annotated bibliography of recent Russian archaeological publications which relate specifically to that area.

SOUTHAMPTON AND COATS ISLANDS. From Henry B. Collins of the Bureau of American Ethnology there is important news of the last 2 seasons of field work which he directed on Southampton and Coats islands in Hudson Bay. In the summer of 1954 a party consisting of Collins, J. Norman Emerson, William E. Taylor, Jr., and Eugene Ostroff carried out major excavations in Dorset and Sadlermiut sites on Southampton as well as more limited investigation in a Sadlermiut site on the north shore of Coats. The work was sponsored by the Smithsonian Institution, the National Museum of Canada, and the National Geographic Society. In 1955 Collins, Emerson, and Taylor returned with James V. Wright as the fourth member of the party, and during this season the American Philosophical Society acted as a major supporting organization. It was expected that Taylor would return for a third season's work in June, 1956.

Excavations were made at 5 old sites in the vicinity of Native Point, which lies about 40 miles down the coast from Coral Harbor on the south shore of Southampton: (1) a large Sadlermiut village, abandoned in 1903, and consisting of over 75 stone and sod house ruins and numerous stone graves, caches, and cairns; (2) the Lake Site, a smaller Sadlermiut site 2 miles to the east; (3) T-1, a large proto-Dorset site on the top of a 70-foot-high headland (the name is derived from "Tunermiut," the Aivilik Eskimo name for Native Point); (4) T-2, a small site that yielded typical Dorset material, adjacent to the Sadlermiut village; (5) T-3, another small site closely related culturally to T-1 but probably a little later, situated at an elevation of 40 feet.

The proto-Dorset site, T-1, comprised shallow midden deposits which covered a discontinuous area of over 30 acres. No graves or recognizable house remains were found. The midens were extremely rich in animal bones and refuse, and an analysis of the mammal bones excavated there, compared with those taken from the Sadlermiut site, revealed some striking differences in the food economy of the early Dorset and Sadlermiut people. The seal, for instance, was most important in both societies and accounted for close to 65% of the large bone sample counted from each of the T-1 and Sadlermiut sites. Walrus was next important: 12.4% of the T-1 sample and 5.3% of the Sadlermiut. Collins underlines the evidence that the proto-Dorset people made little use of caribou, 0.8%, in contrast to 11.8% for the Sadlermiut. Fox bones were more numerous at T-1, but dog bones were completely lacking there. This latter fact shows that the proto-Dorset people, not possessing the dog sled, had no effective means of winter transportation, and it probably explains why they got so few caribou.

Several thousand artifacts of stone, bone, and ivory were excavated at T-1, but there was no trace of wood. Some of the material is characterized by standard Dorset features and techniques of manufacture, and a number of common Dorset types were found, including needles, small triangular projectile points, slender barbed dart points, chert and nephrite implements with rubbed edges and sides, thin sherds of steatite, a few burins, and hundreds of microblades. However, the lack of some typical Dorset features, plus the fact that a majority of the artifacts represent new types which are limited thus far to this one site, indicate that T-1 represents a heretofore unknown phase of Dorset culture. Among the new types are long, rectangular side blades, backed blades, and microlithic triangular blades which remind Collins of Mesolithic types from Eurasia. Therefore, he believes this particular phase of the general Dorset pattern may best be described as formative, or proto-Dorset. A radiocarbon date of 2000 ± 230 years obtained from charred wood is consistent with this interpretation.

Other evidence obtained from the excavations in Sadlermiut sites on Coats and Walrus islands suggests that the Sadlermiut, instead of being the last of the Thule Eskimos, were a Dorset remnant with a heavy Thule overlay.

KOTZEBUE SOUND. J. Louis Giddings of the University of Pennsylvania has received a grant from the Arctic Institute of North America in support of a reconnaissance which he plans to conduct this coming August and September. He will explore both the shores and the tree line around the Escholtz Bay region of Kotzebue Sound, seeking Eskimo sites that can be dated in his Kobuk-Norton Bay treering chronology. Giddings has been building this chronology since 1940, when he first worked on the Kobuk River, and it now extends back unbroken for almost a thousand years to A.D. 978. He hopes that further exploration will help to push this lower limit back even further.

CORONATION GULF. During July and August of 1955 Elmer Harp, Jr., of Dartmouth College and Ralph E. Miller of the Dartmouth Medical School conducted an airborne reconnaissance in the Coronation Gulf region of the Northwest Territories. This research was sponsored by the American Philosophical Society and aided by a supplementary grant from the Research Committee of the Faculty of Dartmouth College. The trip was made in Miller's plane, a Piper Tripacer equipped with dual flight controls and Edo floats. Major base camps were established at Coppermine, the estuary of Tree River, the mouth of the Hood River in Artcic Sound, in Bathurst Inlet at the mouth of the Burnside River, at Contwoyto Lake on the interior barrens, and at Dismal Lake. From each of these bases exploratory flights were taken over the surrounding country, first at medium altitude for the bird's eye view and then at low level to scout for sites. Suitable landing areas in lakes and bays were often conveniently near those strategic locales which demanded further investigation on the ground. The light plane proved highly satis-

factory as a means of covering this type of terrain. The 2 men thought nothing of flying 100 or more miles away from camp for a day of ground work in some promising area, and then returning to base for supper at a reasonable hour. There are many logistical problems which must be solved in such an operation, but careful organization and planning make it relatively safe, and the high degree of mobility is more than worth the cost. Close to 1000 miles of coastline in Coronation Gulf were flown at low altitude and everywhere the physical evidence of contoured graveled strand lines attests to the uplift of the land in recent centuries. This explains why all collections made along the coast must be attributed to modern or relatively recent Eskimos. A number of the projectile points and knives have blades of native copper, and in several cases of iron. Preliminary inspection indicates that the greatest age among these coastal finds is represented in a series of harpoon heads, found on Cape Hearne, which are of Late Thule type.

Sites discovered from 60 to 100 miles back in the interior, around Dismal Lake and Kamut Lake, show much greater antiquity. These were situated on eskers and raised beach lines, and contained 2 distinct complexes of chipped stone artifacts. One of these, the more common and widespread, consists of large, often coarse and undifferentiated forms of scrapers, and projectile points or blades which resemble Yuma, Plainview, and Angostura types. The other is a microlithic complex which includes lamellar blades, some retouched, and minutely flaked end and side blades and scrapers. Two probable burins have been distinguished in this material.

Analysis of these finds has not been completed, but it appears that the above mentioned complexes are entirely separate manifestations. Although no true Dorset types are to be noted among the microlithic finds, it may be suggested that here is some slight evidence of a cultural development in the central Arctic which, still being oriented to inland subsistence patterns, represented a stage intermediate between the Denbigh Flint complex of the west and the later Cape Dorset Eskimo culture of the eastern Arctic.

YUKON TERRITORY. Richard S. MacNeish of the National Museum of Canda returned in 1955 for his second season of work in the Yukon Territory at the Firth River site near the Alaskan-Canadian border. This site undoubtedly has tremendous potential importance for all archaeology in the eastern North American Arctic, for its stratigraphic sequence includes 9 cultures. It is in this area that the Brooks Range-Richardson Mountains system bulges northward and makes of the coastal plain a funnel that is only a few miles wide, and apparently most, if not all, of the early hunters who moved eastward along the coastal fringe were forced to go through this passage. MacNeish, in his preliminary analysis, breaks down the 9-culture sequence as follows: the 3 latest levels are Eskimo, and the earliest of these contains Norton Check-stamped pottery. Earlier than these are 3 other pottery-bearing levels, containing Cord-marked, Dentate-stamped, and Grooved Paddle types, as well as microliths and burins. At the lowest levels are 3 nonpottery cultures, the latest of which is very much like the Cape Denbigh complex. Beneath this, the second culture has Plainview and Angostura points along with crude prismatic blades and crude burins, while the earliest stratum of the entire sequence holds a few coarse choppers and scrapers. The excavation of this site will be continued in the summer of 1956.

SOUTHWEST ALASKA. Wendell Oswalt, reporting from Bethel, Alaska, has news of field work dating back to 1954. In June and July of that summer he operated in the Katmai National Monument, under the sponsorship of the National Park Service, and the results of his survey and excavation have their nearest parallels with de Laguna's Kachemak Bay III-IV materials. In August of that same year he worked in the middle Kuskokwim River country, doing both historic archaeology and ethnography. The University of Alaska has a long range program of investigation in this region, and Oswalt is now conducting a community study at Napaskiak and will continue the site survey of the lower Kuskokwim, as well as making preliminary excavations at the early historic Russian settlement of Kolmakof this coming summer.

The Assistant Editor for the Arctic hopes to establish contact with all Arctic enthusiasts in the near future, but there may be some whom he will miss for lack of a proper address. Please make life happier for him and earn his lasting gratitude by occasionally sending him an unsolicited report of northern activities.

Assembled by ELMER HARP, JR.

PACIFIC COAST AND GREAT BASIN

BRITISH COLUMBIA. Charles Borden of the University of British Columbia reports that several archaeological projects are in the planning stage, including continued work at the Marpole site and a site survey in the Georgia Strait area. Borden is preparing the final reports on completed archaeological investigations in the coastal and interior areas of British Columbia.

Wilson Duff of the Provincial Museum, Victoria, is working on a comprehensive study of stone sculpture of the Fraser Valley and Gulf of Georgia region. This subject holds considerable theoretical interest for the student of Northwest Coast and Plateau prehistory.

WASHINGTON. University of Washington plans for another summer's salvage excavation in The Dalles reservoir are going ahead. In addition to other resources available for the work, endeavors are being made locally to enlist the aid of the Oregon Archaeological Society.

OREGON. The University of Oregon conducted a summer field session in archaeology on the northern Oregon coast as a stage in its program of Oregon coast prehistory. The coast has been completely surveyed and all sites have been evaluated. The program looks forwad

to systematic excavation in critical areas, moving over a period of years from north to south. Further work is planned east of The Dalles, Oregon, on the Oregon side of the Columbia River. The most important site remaining is that at Big Eddy, which, until recently, was occupied by houses for the personnel at the Big Eddy offices of the Corps of Engineers.

UTAH. The Great Basin Archaeological Conference will hold its 1956 meeting on the campus of the University of Utah August 19-21. Details can be secured from Clement Meighan, Department of Anthropology and Sociology, University of California, Los Angeles 24, California.

CALIFORNIA. The Region Four Office of the National Park Service reports that a small amount of money has been made available to extend their contract with the University of Southern California for the survey in Death Valley National Monument.

Phil C. Orr of the Santa Barbara Museum of Natural History has received 2 radiocarbon dates for archaeological sites on Santa Rosa Island. An age of 7070 ± 250 years was received for a Dune Dweller cemetery, Red Head phase, and an age of 29,650 ± 2500 years for charred mammoth bone from a "barbecue" pit.

The Archaeological Survey Association of Southern California held its winter meetings at the Southwest Museum on January 28. The following officers were elected for this year: President, William J. Wallace; Field Leader, Freddie Curtis; Recording Secretary, Charles Rozaire; Secretary-Treasurer, Louella Grafton.

A class in archaeological field methods from the University of Southern California has been conducting salvage excavations at a site in Redondo Beach. Previous work at the site in 1903 and 1923 resulted in the uncovering of a number of burials which were accompanied by some of the richest and most unusual grave goods yet found on the southern California coast.

Assembled by R. D. DAUGHERTY

SOUTHWEST

ARIZONA. The University of Arizona's archaeological field school opened its eleventh season at Point of Pines on June 15, with Raymond H. Thompson as Assistant Director. In addition to the excavations usually conducted in the late prehistoric sites of the region, attention will focus on an alluvial site on Cienega Creek which was discovered last summer. This site produced a preceramic horizon with cremations, projectile points, and stone pipes, which represent a wholly new complex. Beneath the bed which produced the above evidence and in a stratigraphically older deposit there is material which typologically relates to the Chiricahua stage of the Cochise culture.

In February the Arizona State Museum resumed work on the Lehner Ranch mammoth site near Hereford, Arizona, in the San Pedro Valley. While no new artifacts were added to the inventory, a much clearer picture of the geology was obtained and the faunal assemblage was expanded. The animals represented are mammoth, bison, tapir, and horse. Two distinct hearths, each producing good samples of charcoal for radiocarbon analysis, also occurred in the bone pit and make fairly certain the fact that some food preparation was done on the spot. The artifact count stands at 13 projectile points of Clovis type and 8 cutting and scraping tools, presumably used in the butchering of some of the animals.

The Amerind Foundation, Inc. is making an archaeological survey of certain areas in the Gila and San Pedro valleys in search of ruins which might fulfill the needs of their next expedition which will study the period of the "Great House Builders" of southern Arizona.

At the Museum of Northern Arizona there have been several staff changes during the course of the winter. David Breternitz has replaced Robert C. Euler as Curator of Anthropology. In June Edward B. Danson will become the Assistant Director, replacing Malcolm Farmer who has resigned that position in order to continue work on his Ph.D. dissertation at the University of Washington.

The Museum of Northern Arizona hopes that as many archaeologists as possible will attend the Pecos Conference which will be held at the Research Center of the Museum on August 16, 17, and 18. For any additional details of the Pecos Conference write the Museum.

Robert Euler is on leave of absence from the Department of Social Science, Arizona State College at Flagstaff, and is continuing his study of prehistoric and historic sites in the Walapai country. Euler, assisted by Paul Ezell and Henry Dobyns, excavated what appears to be a prehistoric-historic Walapai cave site and a historic Yavapai shelter in March of this year. These studies will form part of his doctoral disseration to be presented at the University of New Mexico.

Sally Van Valkenburgh, of the National Park Service, has completed her survey of the north rim of Walnut Canyon and with Lee Able also surveyed Casa Grande National Monument.

NEW MEXICO. The summer field school of the University of New Mexico, under the direction of Florence Hawley Ellis, includes both ethnological and archaeological studies. Work is centered in the Rio Grande Pueblo area with concentration upon Basketmaker III archaeology and studies of modern Pueblo material culture.

The archaeology of New Mexico was aided by the spring winds that uncovered Folsom points, Atrisco points, "J" points, and others, both east and west of Albuquerque. The winds also revealed 2 more Basketmaker III sites, thus helping to refute the general opinion of 20 years ago that the Basketmaker did not inhabit the middle Rio Grande.

Paul S. Martin and John Rinaldo, of the Chicago Natural History Museum, planned to return to the Southwest in May. During the course of the winter the report on the excavations at the Foote Canyon site, the latest

Pueblo occupation in the Blue River Valley, has been written, and Martin is writing a "popular" account of the findings of their excavations in New Mexico over the past 17 years.

COLORADO. At Mesa Verde last summer's excavation was in a small mesa-top pueblo dating from late Pueblo II or early Pueblo III times. The site was selected because of the lack of surface evidence of a kiva. Intensive testing proved that no kiva was present. The ruin contained 7 rooms and several small binlike enclosures and in plan is radically different from any ruin previously excavated.

The survey of archaeological sites on Chapin Mesa, which was started 4 years ago, has been completed by Al Lancaster and various seasonal archaeologists. Chapin Mesa, the mesa on which park headquarters is located, is one of a score of long narrow mesas making up the Mesa Verde. In all, 956 sites were surveyed including: 191 cliff dwellings, 708 mesa-top ruins, 46 groups of farming terraces, 5 groups of pictographs, and 6 shrines. As the south end of Chapin Mesa is in the southern Ute Indian Reservation, it was not surveyed; a survey of this area might bring the total number of ruins on Chapin Mesa to over 1200.

Robert H. Lister, of the University of Colorado, reports that he spent 5 weeks in Chihuahua and Durango, Mexico, during December and January continuing his study of cove sites in the northern Sierra Madre Occidental.

The Division of Anthropology of the University of Colorado is offering 2 courses in archaeological research during the first term (June 15 to July 20) of the 1956 summer session. Robert H. Lister will direct undergraduate students who have had no previous field experience in excavations at Mesa Verde National Park. Joe Ben Wheat will direct advanced students in Basketmaker and early Pueblo sites near Cortez, Colorado.

Assembled by E. B. DANSON

PLAINS

As this is being written, in March, plans are afoot for a good deal of activity in the Plains area. As always, river basin salvage looms most important on the schedule. Federal funds for Missouri Basin salvage are slightly increased this year over last, and although these funds are still inadequate to do a reasonable sampling job, more activity is anticipated for 1956 than was possible in 1955.

ALBERTA. H. M. Wormington of the Denver Museum of Natural History will continue the archaeological project begun in Alberta last year, under the auspices of the Glenbow Foundation. Several Early and Middle Prehistoric sites near Edmonton and Peace River are to be tested in June, July, and August, and it is expected that one or more of them will be dug intensively. E. Mott Davis will be participating, and several students will assist.

NORTH DAKOTA-SOUTH DAKOTA. Most of the Missouri Basin salvage work in the Plains will be along the Middle Missouri — the stretch of the Missouri River in North and South Dakota which is coming to be thought of as a separate archaeological area comparable to the Central Plains in culture-historical significance. In 1956 nearly all the work will be in the Oahe Reservoir area which extends from below Bismarck, North Dakota, about 250 miles downstream nearly to Pierre, South Dakota. There is a great number of large sites in this reservoir area, and it will not be possible to investigate a proper sample of them before flooding takes place. This circumstance makes the choice of sites to be dug a critical matter requiring the explicit formulation of key archaeological problems and the appraisal of sites in terms of their probable bearing on those problems. As of this writing, a number of field workers are still considering the problem which site to dig in 1956.

The State Historical Society of North Dakota, cooperating with the National Park Service, will have a party in the field under Alan R. Woolworth and W. Raymond Wood from June 15 to September 1, with headquarters in, of all places, the girls' dormitory of the Agency school at Fort Yates, North Dakota. They plan to dig earth lodges and cut strata trenches at 2 sites: the Demery site (39CO1), a possible Arikara village straddling the North Dakota-South Dakota state line, and the Fireheart site (32SI2) which has an "Archaic Mandan" component. An intensive reconnaissance of this part of the Oahe area is also planned. Woolworth's report on the excavations at Grandmother's Lodge (32ME59) is expected to be published in *North Dakota History* in the near future.

Near Mobridge, South Dakota, the W. H. Over Museum of the University of South Dakota, in collaboration with the South Dakota Archaeological Commission and the National Park Service, will dig at 3 village sites: Swan Creek (39WW7) which will have some final checking, Payne (39WW302), and site 39WW303. (This last site is called the Blacktail site in one piece of information received by the Assistant Editor, and the Whitetail site in another. We do not wish to take sides.) Both Payne and 39WW303 are believed to contain La Roche components. The field party will be led by Roscoe Wilmeth, who has recently joined the Museum staff as Curator of Anthropolgy.

Waldo R. Wedel of the U.S. National Museum, assisted by George Metcalf, will conduct final excavations at the Cheyenne River site (39ST1) at the mouth of the Cheyenne River, and will then move a short distance north to the Black Widow site (39ST3) where he will follow up earlier investigations by Paul Cooper in 1952.

In addition to Wedel's party, the River Basin Surveys expects to have 4, and perhaps 5, parties excavating sites in the Oahe Reservoir area from the middle of May until the end of September. Robert L. Stephenson plans to map and test the huge Fort Sully Indian site (39SL4) preparatory to conducting full-scale excavations in 1957. G. Hubert Smith will investigate a number of 19th

century historic sites. Richard P. Wheeler and Carl F. Miller, and possibly a third archaeologist, will lead parties digging at a number of sites yet to be selected.

David A. Baerreis and a field party from the University of Wisconsin, cooperating with the National Park Service, will also excavate a site in the Oahe Reservoir area.

NEBRASKA. The Department of Anthropology of the University of Nebraska at Lincoln was host to the Annual Meeting of the S.A.A., May 3-5. This is the first time the Society has met in the Plains area since the Norman meeting in 1950.

The Nebraska State Historical Society, whose modern museum in Lincoln is growing in reputation for its outstanding displays on the Indian and white history of Nebraska, is opening another museum at Fort Robinson near Crawford in the northwestern corner of the state. Roger T. Grange, Jr,, an anthropologist, is Curator of the new museum. Fort Robinson was the center of activities in the final Sioux and Cheyenne wars, and the displays will emphasize the history of the area since 1870, but a number of archaeological displays are included. Grange will be keeping an eye out for archaeological sites in the vicinity.

Marvin F. Kivett, Director of the Nebraska State Historical Society Museum, will lead an archaeological field party digging at the site of Fort Atkinson, just north of Omaha, for a 2-month period beginning in mid-June. This work is part of a historical and archaeological project studying the important role played by Fort Atkinson in the history of both Indians and Whites in the Central and Northern Plains in the early 19th century. This fort was the earliest military post in the Central Plains, dating from 1819. It was established in order to open up the area for the fur trade, and was a center of early trading activity. It was the base for operations against the Arikara in 1823.

The laboratory of the Missouri Basin Project, River Basin Surveys, in Lincoln, has undergone a face-lifting in anticipation of the activities on the Middle Missouri which have already been described. A stenographer, photographer, and part-time file clerk have been added to the staff, and laboratory activity is being stepped up. Robert L. Stephenson returned on January 10 to resume his duties as Chief of the Project, after an extended academic leave of absence. G. Hubert Smith has completed a manuscript on the excavations at Fort Berthold II (39ML2), which is intended for publication in a BAE Bulletin as one of the River Basin Surveys Papers.

WYOMING. David Gebhard of the Roswell, New Mexico, Museum will have a field party out for 6 weeks in southwestern and central Wyoming. They will look into a probable Fremont culture site near the Colorado-Wyoming state line, and a series of sites in the Big Horn Basin.

KANSAS. At Kansas State College in Manhattan, Linwood L. Hodgdon reports that a small modern American Indian Museum has recently been opened in one wing of the College Library. The exhibits emphasize the Plains and include a model of an Upper Republican earth lodge, based on excavations near Manhattan in 1953. The Museum is attracting large numbers of visitors. Hodgdon has received a small research award from the American Association for the Advancement of Science to conduct limited archaeological investigations of earth lodges recently found in the vicinity of Manhattan.

TEXAS. Richard E. Johnson of Fort Worth reports that the Tarrant County Archeological Society was organized in October, 1955, and has 2 field projects under way: an archaeological survey of Tarrant County and a salvage program for a local area soon to be inundated. A series of lectures is being given on archaeological techniques and on Texas archaeology.

Assembled by E. MOTT DAVIS

NORTHERN MISSISSIPPI VALLEY

ILLINOIS. John C. Mc.Gregor of the University of Illinois has been on sabbatical leave and has completed for the University Press the manuscript on the Pool and Irving sites, Illinois Hopewell. He was assisted by Elaine Bluhm of the Chicago Natural History Museum.

The University of Illinois will sponsor an archaeological field project on the Mississippi river near Hull this summer to learn more about earliest Hopewell and Black Sand relationships. This will be a student party with university credit. Jeremiah F. Epstein, Hunter College, New York, will be field supervisor.

The Illinois State Museum is carrying on another season of field work at the Modoc Rock Shelter, June 11 to August 18, with 15 students under the direction of Melvin L. Fowler.

Stuart Struever of Archeological Research Incorporated excavated a Hopewell site in northern Illinois during the summer of 1955. The site covers the period from Middle Hopewell through late Woodland occupations.

On January 21 and 22 a group of archaeologists met at the invitation of John C. Mc.Gregor to discuss problems of salvage and site surveys in Illinois, particularly in terms of incorporating the work with the impending highway construction program. The Illinois Archaeological Survey was formed for unifying and standardizing site surveys, with John C. Mc.Gregor president and Elaine Bluhm secretary. An informal conference, to meet in October of each year, was established to discuss and present current information on the archaeology of Illinois and contiguous areas.

Preston Holder of Washington University in St. Louis, received a grant from the American Philosophical Society for salvage archaeology at the Kunneman Mound in the Cahokia area.

At Southern Illinois University analysis of the excavated material from the Cache River Valley is continuing, and the site survey program resulted in the location of over 50 new sites in the eastern part of the valley. All of these were Archaic, although 10 sites showed

slight traces of Woodland occupation. The Anthropology Club at Southern Illinois University is planning to do extensive testing of a large Woodland site near Crab Orchard Lake.

INDIANA. The Indiana Historical Society sponsored the Indiana University Field School at Angel Mounds once more during the summer of 1955. Work was carried on in new areas, the most interesting of which was Mound A, the largest of the group. As a result of the excavations on the mound it is now known that the conical offset was erected on the top of the upper mound terrace and that it covered a burned structure of some sort, the exact nature of which is as yet unknown.

Glenn A. Black has been granted leave until February, 1957, and therefore will not conduct a field school during the 1956 season.

J. C. Householder and Downey Raibourn completed work at the McKinley Site, of Archaic affinity, near Noblesville, Indiana.

James H. Kellar is gathering data on all known Stone Mounds and their content in the Ohio Valley. The resulting report will be published by the Indiana Historical Society.

IOWA. Reynold J. Ruppé of the State University reports that the Turin finds of last summer have created a great deal of interest in anthropology both on the campus at Iowa City and throughout the state. A course on New World archaeology was presented for the first time. The material from the Mill Creek site is almost completely analyzed and will be published shortly. An exhibition on Iowa archaeology has been installed in the library at the university. Seven students are majoring in archaeology and will participate under the direction of Ruppé in summer field work at the Mill Creek site sponsored by the State University of Iowa and the Sanford Museum of Cherokee.

MINNESOTA. The Science Museum of St. Paul will complete this summer the third and final year of its archaeological excavations at Spring Lake, Dakota County. In addition to test excavations, 4 sites ranging from Middle Woodland to Upper Mississippi associations have been excavated. The field party this summer is under the direction of Elden Johnson and will excavate 4 sites. The party will be supplemented by Louis H. Powell, who will interpret the well-developed Mississippi River terrace system in the area, and Philip Taylor, who will continue his zoological studies. Publication of the completed site reports and a report by Gilbert A. Leisman, Kansas State Teachers College, on the plant ecology of the area, is now in progress. A series of museum displays interpreting the finds at Spring Lake in terms of the broader prehistory of eastern North America is being completed.

A meeting was held March 5 at the Historical Building in Minneapolis. At that time an organization was set up to be known as the "Council for Emergency Archaeological Salvage" which will be administered by the Minneseota Historical Society with Russell Fridley of that institution as chairman. This council will consider such problems as a state wide archaeological survey and emergency salvage.

A University of Minnesota party of 4 students under the direction of Lloyd Wilford spent 3 weeks at the Bryan site on the Cannon River west of Red Wing. This site yielded a mixture of Silvernale, Cambria, and Oneota pottery types. Three small pit houses were found in 1954, none in 1955, although a number of pits and a quantity of sherds and artifacts were found. At Lake City, on the Mississippi 17 miles below Red Wing, 2 mounds were excavated. Though no artifacts accompanied the burials found in them, they are tentatively ascribed to the Middle Woodland period. At the type site of the Great Oasis culture, which is situated on the bank of the extinct lake of that name, near the headwaters of the Des Moines River, 2 weeks were spent in searching unsuccessfully for burials. Three miles north of Henderson is a large group of mounds on a high point between the Minnesota River and High Island Creek. One of the largest mounds was excavated and found to have at its center a rectangular pit, shallowly dug into the subsoil, the long axis of which was east-west. The pit was filled with secondary burials in a very poor state of preservation. Above the pit was a covering of fair-sized logs, lying north-south. Near the top of the mound fill was an intrusive burial, a fully-extended primary burial, with which was associated a small mortuary pot, unquestionably Oneota. The mound is clearly pre-Oneota and is ascribed to the Southern Minnesota aspect, and to the Middle Woodland period.

OHIO. The joint archaeological field session of the Ohio State Museum and the Ohio State University will again be in the Circleville area during the first term of the summer quarter. It is planned to excavate one of 2 small mounds just southeast of the Wolford Group excavated last summer. The work will be under the direction of Raymond S. Baby, assisted by R. M. Goslin and J. Schaeffer.

MISSOURI. The tenth field session of the University of Missouri is being conducted near Ste. Genevieve, about 65 miles south of St. Louis. Besides excavation in a Woodland and a Mississippi village site, brief investigations will be made of Archaic and of historic French occupations of the area.

Assembled by M. L. FOWLER

SOUTHEAST

FLORIDA. In October, the Florida State Museum sponsored a series of tests in the Turner River site near Everglades City, Florida, with W. H. Sears in charge. This is one of the largest Glades area sites, containing over 30 oyster shell mounds averaging 20 feet in height spread in 2 rows along a quarter mile of Turner River. Tests indicate occupation in the late Glades I and the Glades II periods.

In November and December, the Museum carried out a survey and testing program on a 500-acre tract near the mouth of the St. Johns River. Included in the tract are 6 distinguishable sites. W. H. Sears was in charge of the program, undertaken on a National Park Service contract. Shell midden deposits begin in the Deptford period, or earlier, and continue through to the historic level. One St. Johns Ib Weeden Island period burial mound was located and tested.

The 8th annual meeting of the Florida Anthropological Society was held at Rainbow Springs on February 25. Over 80 members attending heard 19 papers delivered by members on various phases of Florida anthropology and history.

The Florida State University, Department of Anthropology and Archaeology, has discovered a site near the mouth of the Aucilla River that appears to have been continuously occupied from the Archaic period to historic times. Sherds present include steatite, fiber tempered, Deptford, Swift Creek, and Fort Walton. Tremendous quantities of flint scrap indicate usage as a chipping station. There is a possibility of underwater preservation of organic materials. Other survey activities have included the Wakulla Beach section, where a site was located that is either a very late Weeden Island II or an atypical Weeden Island complex.

Local collaborators report a burial in a cave near Marianna which yielded a circular copper gorget associated with a shell gorget bearing incised dancing figures with speech scrolls, similar to one from the Yarnell site in eastern Tennessee.

William C. Lazarus has excavated in a Fort Walton village site in Fort Walton beach. This is one of the many sites on the Florida northwest coast being destroyed by urban developments. Lazarus also collected 2 oblate spheroid "simple stamped" Poverty Point pottery objects from a site in Fort Walton beach.

The Vero Man skull, longbones, and artifacts from the site, on loan from the Florida Geological Survey, are now on exhibit in the museum of the Department of Anthropology and Archaeology.

Hale G. Smith and Charles H. Fairbanks investigated a report of the discovery of armor near Panama City. It proved to consist of an apparently complete brigandine made of overlapping iron plates fastened with copper rivets to a fabric. Probably made in Italy, it has been identified by Harold L. Peterson as dating from before 1535. It had been found in a blowout in a region of young shifting dunes on an open beach. A small fresh water stream is nearby, but there is little likelihood of any in situ remains.

GEORGIA. Lewis H. Larson is analyzing materials from 2 seasons of excavation in Mound C at Etowah. A. R. Kelly is setting up a new laboratory at the University of Georgia, moving collections made over the last 8 years. In February, Kelly visited fiber-temper period and later sites in the Ogeechee River drainage. John H. Cain, of Avera, Georgia, had made surface collections from 30 sites in the area. Several of these represent a Stallings Island occupation with fiber-tempered pottery in the top levels. This is particularly interesting since fiber-tempered sites disappear in north Georgia where the earliest ceramics are the fabric-marked Kellogg and Dunlap types. The new data may help to delimit the eastern frontier of the fabric impressed pottery. Kelly has also recently inspected new sites near Lumber City and Adel, which include ring-shaped earthworks, tentatively regarded as some sort of hut rings. Near Lumber City, at the source of the Altamaha, Kelly visited a site reported by A. Y. Napier. Sand hillocks, one of which is probably a mound, occur on this rather extensive site on which are found, horizontally separated, Deptford, a late Swift Creek or Kolomoki Complicated Stamp, and cordmarked pottery. A similar site has recently been disclosed south of McRae in an extensive cut-and-fill operation made by the State Highway Department.

During the fall and winter, the Department of Sociology and Anthropology at the University of Georgia worked on the mapping and photography of several newly discovered stone mound sites in north Georgia. These included 2 stone rings in Habersham County, a single large, but disturbed, mound in the Etowah Valley, and a group of 30 to 35 mounds north of Athens.

VIRGINIA. An intensive field campaign lasting 15 continuous months at Jamestown Island closed December 2, 1955. Headed by John L. Cotter, and employing at various times Edward B. Jelks, Joel L. Shiner, and Louis Caywood, the purpose of this field work was to complete all tests in the main habitation area of the first permanent English settlement before building and landscaping developments were undertaken for the 350th anniversary celebration scheduled for 1957. More than 6 miles of exploratory trenches supplemented the various area excavations and tests begun in 1934 and continued sporadically through 1941 by J. C. Harrington, Carl F. Miller, H. C. Forman, A. W. Pond, J. T. Zaharov, H. S. Day, C. Benson and others. Results of the recent field work contributed materially to a comprehensive knowledge of land use and cultural remains at various periods of 17th century occupation by the settlers and by the pre-17th century Indians. Six major brick foundations were discovered including a large row house and 2 mansions of considerable importance. One hundred fifty other features were also recorded, including evidence of the first ironworking, iron making, pottery making, brickmaking, and gunsmithing by the English in the New World. Beside the kilns, hearths, shops, refuse pits, and numerous drainage and property line ditches, the earliest known ice storage pit in the New World was identified. Discoveries by Shiner and Caywood demonstrated the location of the earliest-known cemetery at Jamestown. Following intensive study of background data, previous excavations, and the artifacts and data from the recent field work, reports on various units of the Jamestown explorations will be written. With the collaboration of Museum Curator J. Paul Hudson, specialist in 17th century arts and crafts, who has been supervising the

laboratory preparation of Jamestown and Yorktown artifacts, a popular study on the rediscovery of Jamestown will be produced for the 1957 celebration. Data and specimens will be employed in many exhibits now planned for the Jamestown museum (under construction) and for numerous outdoor on-the-site exhibits which will interpret visually James Citty in the 1600's. Already constructed is an in-place exhibit housing a cross section of 3 Jamestown occupation zones in an earth profile through a Confederate earthwork of 1861. Below the earthwork lies a 17th century humus zone filled with artifacts, and below this, the only positively-aboriginal Indian village site on the island. The exhibit was developed from a test made last year by Joel Shiner. With some foundations left open, and others marked above ground, the First Settlement area will be fully interpreted to the public by 1957.

Floyd Painter has excavated a colonial cellar on Lake George in Princess Anne County, under the auspices of the Norfolk Museum. Collections, dating 1620 to 1650, contain Dutch, Spanish, Italian, German, and English artifacts.

TENNESSEE. Two minor investigations are under way within 80 miles of Knoxville. An attempt is being made to recover some information from a site on the Little Tennessee River to be inundated by an Aluminum Company dam now under construction. Bulldozer services have been made available by the company, and members of the Knoxville Chapter of the Tennessee Archaeological Society are working week ends under the supervision of T. M. N. Lewis and Madeline Kneberg. Of the 4 components present, Early Woodland, Early and Late Mississippi, and Cherokee, the last is yielding the greatest amount of data. It is the documented site of the Overhill Cherokee town of Tallassee, furthest upstream of these settlements. The second site is a pure Early Woodland unit. This is another Society week end project carried out under the supervision of Kneberg and Lewis. It is the first pure Early Woodland unit known in the area, and the depth is sufficient to yield a developmental sequence if it exists. Radiocarbon dates are expected.

The first Tennessee site to yield a concentration of Paleo-Indian fluted points and other artifacts has been located near Chattanooga, having been brought to light by seasonal fluctuations of Chickamauga Lake. The site has thus far yielded 14 Clovis forms and variants, and a considerable number of scraping and graving tools.

KENTUCKY. Ellis Crawford reports that the Covington chapter of the Kentucky Archaeological Society is excavating village sites and a burial mound in the Big Bone Lick area. The burial mound was slabbed over with limestone rock. Burial furntiure included such Hopewellian artifacts as cut and drilled deer and bear mandibles and effigy platform pipes. The society is also expanding the archaeological survey of northern Kentucky.

Assembled by W. H. SEARS

MIDDLE AMERICA

As this is written, most 1956 field operations are under way, and results are not yet available, but a few items missed in last issue's sumary of 1955 activities have come to our attention:

MEXICO. George E. Fay, during June and July, 1955, visited 160 sites in the western coastal regions of Guerrero, Colima, and Nayarit and in interior Michoacan, Jalisco, Guanajuato, and Sinaloa; 111 sites were sampled, and 5000 to 6000 sherds and other specimens were collected. Between Ciudad Colima and Tonila, Jalisco, 28 tumuli were recorded, and several of the accompanying village sites were sampled. Fay at present is undertaking a classification of pottery types for Nayarit. In Sonora he found 3 new sites of a complex which is thought to correspond to the San Pedro stage of the Arizona Cochise, with the addition of cobble choppers similar to those occuring in southern California. Fay worked as research associate of the Instituo Interamericano with the help of a grant from the American Philosophical Society. He also made biological and soil sample collections for other institutions.

Southern Illinois University is sponsoring a field session in Durango again this summer, with J. Charles Kelley in charge. The Schroeder site will be further investigated, since many problems have arisen through analysis of the 1954 materials from the site. In addition, a program of surface surveying and minor testing is planned for various parts of Durango.

Last December, Cézar Lizardi Ramos and Florence Müller continued their digging in the vicinity of Tulancingo, Hidalgo. Three km. north of the town, at the site of Huapalcalco, they made excavations in an early sunken court floored with 14 layers of black clay. This they attribute to a horizon equivalent to Lower Ticoman. Adobe fagments suggest that the court or patio was surrounded by buildings and traces of painting were observed on the fragments and on the constructions.

We have a brief note from Heinrich Berlin saying that in addition to his excavations in Preclassic sites in Chiapas he has made excavations in Postclassic mounds, uncovering a multichambered temple with plastered adobe walls.

The activities of the Instituto Nacional de Antropología e Historia have been largely concentrated on consolidation of known structures, but the following discoveries unreported by us before deserve mention: At Tula, Hidalgo, 10 new bas-reliefs representing tlalocs and human figures were recovered in clearing Pyramid C. One bears a large hieroglyph associated with the number nine. Near the Palacio Quemado, a buried wall was followed down 3 m. to a plaster floor with post impressions. Faint traces of design on the mud plaster of the wall depict a deer with an arrow piercing its body. At Cholula, a structure attributed to a late Preclassic phase has been found under construction of Classic date. Three tombs with ceramic offerings, also from the end of the Preclassic period, were uncovered at Tlapacoya, and at Etzatlan, Jalisco, Corona Nuñez explored a burial

shaft described in a recent issue of the new series of field reports put out by the Instituo. This series should keep us abreast of the work being done in Mexico, and it is hoped that its publication will continue.

In December, the Sociedad Mexicana de Antropología held a 7-day session of discussions on Mesoamerican calendar systems. The question of the correlation of Aztec and Christian calendars, recently revived by theories proposed by Ola Apenas and Lizardi Ramos, was not resolved, and it is our impression that the breach between opinions on this and allied matters has not been perceptibly narrowed. The suggestion that a calendar still in use in Oaxaca, reported on by Robert Weitlander, might represent an archaic form added a new and interesting ingredient to the discussions.

Maya Area. The work of consolidation and restoration of buildings in the Puuc sites of Yucatan was continued under the direction of Alberto Ruz Lhuillier. A new group of ruins has been reported 2 km. east of Calkini at Pan-Kanté near X-topon. A description of the site is not available, but judging by the mention of quantites of worked stone, it probably belongs to the Florescent period of the Puuc.

Work at Palenque is somewhat delayed this year, but Robert Rands planned to go down in March to begin his work in connection with a study of Palenque pottery.

E. Wyllys Andrews passed through Yucatan in February on his way to the East Coast, where he planned to map and sample for pottery the site of Xcaret, north of Paamul.

In the highlands, a newly discovered bas-relief found at Kaminaljuyú has attracted attention by its excellent workmanship and unusual style, related to that of the Classic Maya. It appears to have been a large altar broken in several pieces of which only 3 have been recovered so far and represents an anthropomorphic figure with a hieroglyph combined with a bar and dot numeral.

Assembled by Tatiana Proskouriakoff

HIGHLAND SOUTH AMERICA

Expeditions and Excavations. Alfred Kidder II, director of the University Museum expedition to Peru and Bolivia, has returned to the United States. During excavations in Tiahuanaco, Chipria, and Pucara he obtained several radiocarbon samples. He was joined for part of the expedition by Alan Sawyer of the Art Institute of Chicago. Donald Collier, heading the Chicago Museum of Natural History expedition to investigate the cultural sequence of the Casma valley, started work in this area.

Larry Dawson of the University of California's fourth Peruvian expedition studied the Nazca collections at the Museo Nacional de Arqueología y Antropología in Lima and then made a survey of the sites and collections of the Nazca culture in the Ica-Nazca region. Dawson is investigating Nazca stylistic developments.

The Centro de Estudios Antropologicos of the University of Chile carried out excavations at the Los Horcones site north of Viña del Mar, where previous reconnaissance indicated both long occupation and possible relationships with the cultural sequence of the Elqui-Hurtado region. Carlos Munizaga of the Centro de Estudios Antropologicos and Jorge Iribarren of the Museo Arquelogico de La Serena carried out an intensive survey of the area between San Pedro de Atacama and Toconao, aided by the data gathered on a previous reconnaissance by R. P. Gustavo LaPaige, parish priest of San Pedro de Atacama. Their most interesting discoveries were (1) a site with many varieties of incised and punctate sherds; (2) a site with a large pressure-flaking industry and little evidence of ceramics; and (3) many instances of urn burial. These finds promise to fill in large gaps in the Chilean Atacameño sequence and to interrelate it with adjacent Andean cultures.

Conservation and Restoration. The Dirección de Arqueología continued its clearing of the Castillo at Chavin de Huantar. Marino Gonzalez, who is in charge of the work, uncovered a new condor slab (85 by 35 cm.) and 2 stelae. The latter were reported to be found near the Tello "obelisk" in the Sunken Plaza (plaza sagrada according to the Tello plan).

In addition to its supervision of the 2 urban developments in Ancon and San Bartolo, the Dirección de Arqueología is supervising the urbanization going on at Playa Grande with the help of Louis Stumer, who excavated there previously, and at the urbanization La Florida, near the Pampa de Amancaes, where Mejía Xesspe reported Chavin type pottery. Stumer, who previously reconnoitered the site, considers the pottery to be like the incised monochrome types at the recent Ancon cuts and probably somewhat post-Chavin. The site itself consists of 3 mounds.

Arturo Jimenez Borja in collaboration with the Dirección de Arqueología has almost completed restoration of the Inca-Rimac site of Puru-chuco, near Encalada. The rebuilt rooms are being decorated with textiles and pottery found in the nearby site of Huaquerones. This marks the second restoration of a coastal-Inca architectural group. Tello restored part of the Inca section of Pachacamac previously. The other activities of the Dirección de Arqueología e Historia were directed at preventing further encroachment on the famous ruins of Chan Chan and the Pampa of Nazca.

The Dirección de Arqueología e Historia has now been incorporated in the more comprehensive Dirección de Educación Artistic, headed by Cesar Miro. Jorge Muelle, its last director, has been appointed director of the Museo Nacional de Arqueología y Antropología, succeeding Rebecca Carrión Cachot de Girard, who was recently married.

Sporadic Discoveries. New painted wall panels in the Mochica site of Huaca de la Luna have been uncovered. They are being copied by Pedro Azabache, Peruvian mural painter, and should soon be published by the Museo Arqueologico of the University of Trujillo.

Deformed crania of the Colonial period were found in ossuaries of the Santo Domino convent, indicating continuance of the practice of deformation into the Colonial period.

A commission for excavation from the Museo Regional de Ayacucho, headed by José Casafranca, discovered a shrine with remains of what he calls Chavín type ceramics in the Pampas de Chupas, 20 km. south of Ayacucho.

An amateur expedition explored the little known altiplano of far northern Chile. Two sites are reported so far: Chapicollo, a ruin with circular structures, and Guaycuta where small stone "houses" were found in association with red-white-black ceramics. The architecture is of highland type, and the ceramics seem to point to an extension of Arica II influence into the interior.

Assembled by RICHARD P. SCHAEDEL

LOWLAND SOUTH AMERICA

BRAZIL. During the latter part of 1955, Vilma Chiara and Harald Schultz of the Museu Paulista made surface collections from an archaeological site occupied by the present town of Itacoatiara, on the north bank of the Amazon below Manaos, and from a second site some 2 km. outside the same town. These represent different ceramic complexes. The outlying site produced material comparable to that collected by the same investigators from Manacapuru, farther up the river, affording some indication of the territorial distribution of this rather elaborate pottery style.

URUGUAY. The first issue of a mimeographed publication, Boletín de la Sociedad de Antropologia del Uruguay, is dated July-December 1955. This society was organized under its present name in 1951. Among its goals are the undertaking of original research, promoting the teaching of anthropology, assisting in the publication of anthropological monographs, and expediting the exchange of information, bibliography, and publications with foreign associations. One of the projects undertaken by this society is the "location and description of the principal aboriginal archaeological sites in the country." The purpose of the Boletín, which is scheduled to appear twice yearly, is to familiarize anthropologists in other parts of the world with the progress of anthropological investigations in Uruguay. On behalf of one "foreign" society, we should like to express our appreciation and congratulations.

Assembled by BETTY J. MEGGERS

EARLY MAN

CALIFORNIA. Santa Rosa Island, the central member of 3 large islands off the Santa Barbara coast in southern California, has been the scene of intensive excavation and study by the Santa Barbara Museum of Natural History since 1947. Phil C. Orr of the museum staff has been in charge of this work. Late Pleistocene sediments are exposed in seacliffs 75 feet high along the northwestern coast of Santa Rosa Island and contain abundant remains of a dwarf mammoth (see Chester Stock and E. L. Furlong in *Science*, Vol. 68, pp. 140-1, 1928).

In many areas where remains of the dwarf mammoth are found, the clay is burned a brick red with flecks of charcoal throughout. Such fire areas are scattered through the entire depth of these beds between Arlington and Tecolote canyons, but are not found in other, nearby exposures. The Santa Barbara Museum of Natural History has excavated hundreds of bones of the dwarf mammoth but only rarely are they articulated. Skulls usually lack the cranium and vertebrae and ribs are often broken, burned, or missing. On the other hand, pelves, jaws, tusks, and long bones are usually intact. These facts alone suggest that man killed the mammoths, selecting certain parts for food while rejecting others (compare with observations made by Luis Aveleyra A. de Anda on the second mammoth at Santa Isabel Iztapan, in this issue).

Four localities are known in which a large portion of the mammoth skeleton was present in a burned area. The skull was absent in all of them. In one, a chipped stone was weathered from the soil. At Survey Point a large portion of a mammoth skeleton was excavated in 1948 by R. S. Finley and Phil C. Orr. This specimen was exposed exactly midway in a seacliff 74 feet high, the bones lying on a slope of burned clay containing charcoal flecks, apparently in a hole or pit originally.

In September, 1955, with the cooperation of the Western Speleological Institute and the Scripps Institute of Oceanography, the Santa Barbara Museum of Natural History was able to invite Carl L. Hubbs of Scripps, George F. Carter of Johns Hopkins University, and Wallace Broecker of the Lamont Geological Observatory, Columbia University, to visit Santa Rosa Island. Broecker collected samples of burned mammoth bone at the Survey Point locality, on which the Lamont radiocarbon laboratory made 4 age determinations, averaging 29,650 ± 2500 years.

In Tecolote Canyon, a half mile west of the locality from which the above radiocarbon dates were obtained, 2 skulls of the dwarf mammoth were found, both with the cranium destroyed. One was too badly broken to be collected, although the limb bones were well preserved. Natural conditions do not fully explain why so many crania are crushed or missing, but it is suggested that they were deliberately destroyed to extract the brains for food (compare this point, too, with that mentioned by Aveleyra). Comparable conditions are found in more recent Indian sites in this area where thousands of skulls and jaws of sea lion and otter are found, the crania invariably damaged for extraction of the brains. From 5 to 10 feet below the stratum containing the 2 skulls mentioned above, burned cypress stumps were dated by the Lamont laboratory at 17,000 ± 450 and 16,300 ± 500 years, an average of 16,650 ± 450 years. The latter dates, subtracted from the average of 29,650 ± 2500 years for the 4 determinations at Survey Point,

indicate at least 13,000 years for the contemporaneity of man and dwarf mammoth on Santa Rosa Island. It is not yet known, of course, how much earlier this association may have begun, or when the island mammoth became extinct. As this peculiar mammoth was only 4 to 6 feet high, it probably was not very difficult to kill.

Scattered through the mammoth-bearing beds are occasional abalone shells, one of which was found 3 miles in from the present coast. As no animals are known on these islands which could carry heavy abalone shells this distance, one must admit the probability that man was responsible. In the top 10 feet of Pleistocene deposits west of Tecolote Canyon, there are numerous chips of low-grade chert, again indicating the presence of man. Burned mammoth remains are only a few yards away and slightly lower than this deposit. Although lightning is virtually unknown in this area today, the possibility that lightning fires may have burned the mammoth bones and soil in the past must be considered. However, it is difficult to see how natural fires could account for the concentration and depth of the burned soil, or how anything but human agency could account for the dismemberment of the skeletons and removal of certain parts of them in such a consistent manner.

At the top of the seacliff east of Arlington Canyon, a well-defined midden occurs under 12 feet of alluvium. The Lamont laboratory has made radiocarbon determinations of 6850 ± 200 and 6750 ± 100 years on this midden for an average of 6800 ± 150 years. This deposit has all of the characteristics of Pleistocene deposits and lies conformably on them, but the date seems low.

The 3 large islands of San Miguel, Santa Rosa, and Santa Cruz lie 30 miles and more off the Santa Barbara coast, while east of them tiny East Anacapa Island is 12 miles from the mainland. As to how man may have reached Santa Rosa Island some 30,000 years ago, Orr offers the following data: The present maximum sea depth between these islands is about 120 feet, so that during a glacial stage, a sea lower by this amount would have permitted man to walk dry-shod between the present islands. On the other hand, the maximum depth between East Anacapa Island and the mainland is now 706 feet, much too great for a land bridge during any of the late Pleistocene glacial stages. However, with the sea some 300 feet lower than the present, the open-water channel would have been about 400 feet deep but only about 2 miles wide — or less if the sea was lowered by more than 300 feet. Orr believes that such a channel would not have been too difficult to cross by raft or even by strong swimmers. Numerous small mammals did reach the islands over a land connection but this may have long preceded the time of man.

Nevada. In cooperation with the Nevada State Museum, the Western Speleological Institute, directed by Phil C. Orr, has continued the excavation and study of Early Man material from Fishbone Cave in Nevada. Four distinct levels are recognized in this cave, representing 4 climatic stages. In the 2 lower levels, 3 and 4, human habitation is associated with split and burned bones of extinct horse and camel. Wallace Broecker of the Lamont laboratory has obtained a radiocarbon date of 11,227 ± 400 years on the lowest level, "the oldest radiocarbon date for perishable material and human skeletal material in America." Bulletin 2 of the Nevada State Museum has been prepared on Fishbone Cave and only awaits further radiocarbon dates before going to press. Surveys and excavations in other Nevada caves are being conducted by the Western Speleological Institute in cooperation with the Nevada State Museum.

Texas. In February, 1956, members of the Dallas Archeological Society, led by R. K. Harris and Wilson W. Crook, Jr., discovered a series of hearths in the Upper Shuler formation near Lewisville in Denton County. The Upper and Lower Shuler formations have long been recognized as late Pleistocene from their fossil associations and probably correlate with the late and early Wisconsin glacial stages, respectively. It is of great interest that these hearths, consisting of burned earth and charcoal, as well as burned animal bone, are found in more or less circular, basin-shaped pits up to 18 inches or more in depth and from about 4 to 10 feet in diameter. In addition to 3 large hearths, 7 smaller ones have been found at various levels in the Upper Shuler formation. They were witnessed on March 4 by A. D. Krieger, before being explored by excavation. Later, on the systematic dissection of the largest hearth, a fine Clovis fluted point was found in situ within it, and only 20 inches away, and well within the hearth, was found a charred branch some 4 inches in diameter and 7 inches long, a perfect specimen for radiocarbon dating. Charred bone from the same hearth will be useful for other datings. These dates, when available, should provide a fine check on the general suspicion that Clovis points are older than Folsom in the Great Plains region, for Clovis points have not so far been accurately dated.

When the Dallas Archeological Societay had excavated 275 feet of ground around the largest hearth, a second hearth pit at a slightly lower level, and a small area of fired earth nearby, no artifacts in addition to the Clovis point had been found. However, highly significant information on the food habits of the makers of Clovis points, heretofore unknown, was obtained. Remains were found of 2 tortoises, a large bison, a large wolf (?), rabbits, split bones suggestive of small deer or antelope, birds, 3 small mussel shells, and a snail shell, all burned and in situ in the hearth pits. A few years ago, Theodore E. White, paleontologist for the Smithsonian Institution's River Basin Surveys, recovered fossils from the immediate vicinity of the hearths and on the same erosional surface. These included a large camel skull, *Bison taylori*, coyote jaw, an antler base and skull fragment suggestive of mule deer, a lower jaw and articulated hind leg of a young antelope (?), a prairie dog jaw, and numerous fragments of turtle carapace. Recently a mammoth (?) leg bone was found weathering from the same formation some 75 yards

from the excavated hearth pits. This faunal assemblage shows that the makers of Clovis points in this vicinity not only hunted the large, now-extinct Pleistocene mammals, but utilized all sorts of small mammals, many of which survived in the area until the present, and apparently even ate mussels and snails — perhaps even snakes. A field party from Southern Methodist University recently recovered the delicate fossil of a grass-snake skeleton at the same locality.

E. H. Sellards reports that the radiocarbon age determination of 9883 ± 350 years on the Folsom culture horizon at Lubbock, Texas, made by Libby in 1950, has been confirmed by a second test. The original test was made on burned bison bone collected by Glen L. Evans and Grayson Meade in September, 1950, from the basal 3 inches of the Folsom stratum. The second test was made on fresh-water snail shells collected in December, 1952, by Evans and Meade, representing on the average the central (or somewhat below the central) part of the Folsom stratum. The snail shells were kept in storage at the Texas Memorial Museum until October, 1955, when they were submitted to the Lamont laboratory. In December, 1955, an age of 9300 ± 200 years was obtained on this sample. According to Sellards, the age difference between the 2 samples, some 583 years, "is not unexpected considering the difference in stratigraphic position of the two samples."

MEXICO. Luis Aveleyra A. de Anda, Director of the Dirección de Prehistoria, Instituto Nacional de Antropología e Historia, Mexico, reported in March that by a miraculous stroke of luck he rediscovered the famed "carved sacrum of Tequixquiac" in the collection of an old man in Guadalajara. This sacrum of an extinct llama, carved into the semblance of a coyote or wolf face, was described by Bárcena in 1882 but was then lost at about the close of the century. Aveleyra reports that, "There is not the slightest doubt about the identity of the piece, nor its value as a human artifact. . . . If I am not mistaken, the fossil sacrum remains the only example of Pleistocene *art* from the whole continent, with the probable exception of the stone heads from Malakoff, Texas, and the notched bone disks from Lindenmeier, Colorado." He plans to publish a paper on it, with new illustrations and descriptions and documenting its long and hazardous career.

PATAGONIA. Professor Oswaldo Menghin, Museo Etnográfico de Argentina, Buenos Aires, reports that he has completed his sixth expedition to Patagonia. Referring to the article on Tule Springs, Nevada, in *Natural History* for February, 1956, he states that he is much impressed by the similarity between the artifacts shown from Tule Springs and material from the "Mylodon" Cave in Chile and the second level of Junius Bird's excavation in the Magallanes Caves, "which contains, characteristically, many objects of bone as well as stone." Although radiocarbon dates would indicate that Tule Springs (more than 23,800 years) was much older than the Patagonian and Chilean sites mentioned, Menghin advances the hypothesis that they belong to a similar cultural base which he would term "Protolithic." A greater age in North America would naturally be expected if such a culture actually diffused this enormous distance.

Assembled by ALEX D. KRIEGER

SOME RECENT PUBLICATIONS

As in the past, this feature is contributed by the various Assistant Editors for their respective regions. The coding, arranging of the cards they sent in, and the final typing were done by Sydney R. Allen, undergraduate student in anthropology, University of California at Los Angeles.

The following abbreviations are used in the references:

AA	*American Anthropologist*. n.s. Menasha.
AMNH-AP	*American Museum of Natural History, Anthropological Papers*. New York.
Ar	*Archaeology*. Cambridge, Massachusetts.
ASNJ-B	*Archaeological Society of New Jersey, Bulletin*.
ASV-QB	*Archeological Society of Virginia, Quarterly Bulletin*. Staunton.
BAE-B	*Bureau of American Ethnology, Bulletin*. Washington.
CA	*Cuadernos Americanos*. Mexico.
CIW-CR	*Carnegie Institution of Washington, Department of Archaeology, Current Reports*. Cambridge, Massachusetts.
CIW-NMAAE	*Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*. Cambridge, Massachusetts.
CIW-P	*Carnegie Institution of Washington, Publications*. Washington.
CM-AN	*Carnegie Museum, Archaeological Newsletter*. Pittsburgh.
CNHM-B	*Chicago Natural History Museum, Bulletin*. Chicago.
CS	*Ciencias Sociales*. Washington.
CSAJ	*Central States Archeological Journal*. Quincy, Illinois.
E	*Ethnos*. Stockholm.
EG	*Early Georgia*. Athens.
EP	*El Palacio*. Santa Fe.
ESAF-B	*Eastern States Archaeological Federation, Bulletin*. Trenton.
FiA	*Fieldiana — Anthropology*. Chicago.
FHQ	*Florida Historical Quarterly*. Gainesville.
FIA	*Florida Anthropologist*. Gainesville.
FSUS	*Florida State University Studies*. Tallahassee.
GJ	*Journal of Geology*. Chicago.
IAEP	*Instituto de Antropologia e Etnologia do Para*. Belem, Brazil.
INAH	*Instituto Nacional de Antropologia e Historia*. Mexico.
K	*Kiva*. Tucson.
MARR	*Middle American Research Records*. New Orleans.
Mas	*Masterkey*. Los Angeles.
MAS-B	*Massachusetts Archaeological Society, Bulletin*. Attleboro.
MoA	*Missouri Archaeologist*. Columbia.
NAS-B	*Nassau Archeological Society, Bulletin*. Sea Cliff, New York.
NMC-B	*National Museum of Canada, Bulletin*. Ottawa.
NYSAA-B	*New York State Archaeological Association, Bulletin*. Albany.
OAS-B	*Oklahoma Anthropological Society, Bulletin*. Norman.
OAS-NL	*Oklahoma Anthropological Society, Newsletter*. Norman.
P	*Plateau*. Flagstaff.
PA	*Pennsylvania Archaeologist*. Homesdale.
PIA	*Plains Anthropologist*. Lincoln, Nebraska.
PPHR	*Panhandle-Plains Historical Review*. Canyon, Texas.
RCA	*Revista Columbiana de Antropologia, Instituto Colombia de Antropologia*. Bogotá, Colombia.
RMP	*Revista do Museu Paulista*. São Paulo.
RUCC	*Revista Universitaria, Universidad Católica de Chile*. Santiago.
S	*Science*. Washington.
SA	*Scientific American*. New York.
SAP-J	*Société des Américanistes de Paris, Journal*, n.s. Paris.
SAR-M	*School of American Research, Monographs*. Santa Fe.
SJA	*Southwestern Journal of Anthropology*. Albuquerque.
SL	*Southwestern Lore*. Boulder, Colorado.
SM	*Scientific Monthly*. Washington.
SMC	*Smithsonian Miscellaneous Collections*. Washington.
T	*Tlatoani*. Mexico.
TA	*Tennessee Archaeologist*. Knoxville.
TAS-B	*Texas Archeological Society, Bulletin*. Austin.
TICA-P	*Thirtieth International Congress of Americanists, Proceedings*. London.
UA-AP	*University of Alaska, Anthropological Papers*. Fairbanks.
UCAS-R	*University of California Archeological Survey, Reports*. Berkeley.
UCPAAE	*University of California Publications in American Archaeology and Ethnology*. Berkeley.
WHOM-N	*W. H. Over Museum, Newsletter*. Vermillion, South Dakota.
WVA	*West Virginia Archaeologist*. Moundville.

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